PREDICTING COSTS OF HOSPITALIZATION FOR CANCER CARE

Final Report to HCFA

A DRG-Based Casemix Analysis for Cancer Care

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EXECUTIVE SUMMARY

This study investigated how Medicare pays for hospital care for elderly patients with cancer. The term "cancer" encompasses a diverse group of diseases characterized by uncontrolled growth and the spread of abnormal cells affecting many different body systems. More than five million Americans currently have a history of cancer. Although cancer survival rates have improved dramatically in the last 50 years, cancer is the second only to heart disease as the leading cause of death in the U.S. Total economic costs of the disease in 1985 were estimated at $72.5 billion, comprising almost 11 percent of all illness-related costs in that year. Direct health care costs were estimated at $18.1 billion, over $5 billion of which were paid by Medicare. Eight percent of Medicare discharges were related to cancer in 1986 (Scheffler et al, 1987).

How Medicare pays for cancer care has become a matter of intense interest and scrutiny by providers, patient advocacy groups, researchers and policy-makers. Under Medicare's Diagnosis Related Group-based Prospective Payment System, cancer cases are often assigned to clinically heterogeneous groups. Several studies have demonstrated that Diagnosis Related Groups (DRGs) which contain cancer cases exhibit high unexplained cost variance (Iezzoni and Moskowitz, 1984; Mortenson and Yarbro, 1985). Inadequacies or inequities in paying for hospital care for certain types of cancer patients may jeopardize Medicare patient's access to high quality care. Three factors not considered by the DRGs that may have particular relevance for cancer care are severity of illness, intensity of care and purpose of admission (Jencks, 1987).

The major goal of this study was to test whether a purpose of admission typology could be successfully used to categorize cancer cases in three common cancers: lung, colon and breast cancers. Earlier sub-goals of the study were to describe how cancer is classified in the DRG system and to compare grouping discharges by anatomic site of cancer with DRG grouping.

The first, descriptive phase of the study examined a 20 percent sample of Medicare inpatient discharges from FY1984 and found that the three cancers of interest were among the most common in the Medicare population and accounted for a large portion of expenditures. Lung cancer was the most common primary anatomical site (15 percent of cancer-related discharges) and accounted for the greatest proportion of total charges among all cancers (15 percent or $158 million). Colon cancer ranked third as a primary site (9.9 percent) and second in proportion of total charges (14 percent). Breast cancer as a primary site ranked fourth (9 percent) and these discharges accounted for 6.6 percent of total charges.

The purpose of admission typology was tested on two databases: a 20 percent sample of Medicare discharges from FY1985 and a sample of over 700 cases abstracted from medical charts in five Boston hospitals. The typology was developed such that it relied only on data available in the discharge file. Six categories of purpose groups were devised: admission for major surgery with diagnostic evaluation; admission for major surgery without diagnostic evaluation; admission for active treatment with diagnostic evaluation; admission for active treatment without diagnostic evaluation; admission for diagnostic evaluation only; and admission for palliation. The medical chart review used the same purpose categories and was used primarily

to ascertain if reviewers could determine the purpose of admission early on in the admission and whether other variables not available in administrative data made a difference in resource cost.

The major findings of the study are as follows:

o Grouping cancer-related discharges by anatomical site rather than by DRG is less effective in explaining the variation in total charges. Grouping discharges by principal diagnosis within clinically heterogeneous DRGs which contain both cancer and non-cancer cases likewise does not significantly improve explanatory power.

o Administrative data can be used successfully to model purpose of admission. Researchers were able to develop criteria to classify cases into the purpose groups using variables available on administrative files; the purpose group classification had "face validity" when cross-tabulated with the DRGs; and similar proportions of cases fell into the purpose groups for each cancer in both the administrative data analysis and chart review analysis.

o The distribution of discharges in the purpose of admission groups was similar for both breast and colon cancer. For these cancers, the two most common admission purposes were major surgery with and major surgery without diagnostic evaluation, accounting for over two thirds of all cases. The least common admission purpose for breast and colon cancer was for active treatment with diagnostic evaluation (representing less than two percent of cases for each cancer). The distribution of cases for lung cancer, however, was quite different. Diagnostic evaluation only was the most common admission purpose, accounting for well over one third of the cases. Palliation was the next most common purpose, accounting for nearly a quarter of the cases, and active treatment without diagnostic evaluation accounted for another 20 percent of cases. These results are consistent with clinical treatment approaches employed for these cancers.

o For all three cancers, some difference in the distribution of admissions by hospital size by purpose of group was found. Most admissions were in medium to large-size hospitals with over 100 beds. Lung cancer had slightly fewer admissions in small, less than 100 bed, hospitals -- nine percent compared to 13 percent for colon and 12 percent for breast. A higher percentage of admissions for palliation were to smaller hospitals with less than 300 beds than to hospitals with 300+ beds. In addition, a slightly higher percentage of surgery admissions were to hospitals with over 300 beds than to hospitals with less than 300 beds.

o The distribution of admissions by type of hospital control also varied somewhat among the three cancers. The majority of admission were in non-profit hospitals; this held true across all purpose of admissions groups. The public hospitals were most heavily utilized for the palliative and diagnostic evaluation only groups; suggesting that casemix was more severe or that less care was delivered.

o Looking at the distribution of admissions by major statistical area (MSA), across all cancer types and purpose of admission groups, the majority of admissions were to hospitals in urban areas (83 percent for lung, 79 percent for colon, and 80 percent for breast). The palliation group had the most admissions in rural hospitals (28 percent for all three cases). This finding suggests that patients are admitted and/or transferred to more geographically convenient community hospitals for palliative care.

o The DRGs vary by cancer type in their ability to group discharges with similar resource costs. For both lung and colon cancer, the DRGs explained roughly 26 percent of the variation in total charges while for breast cancer the amount explained was only 15 percent. An explanation for this finding is that surgical and medical care for breast cancer patients have similar costs. Thus, the medical surgical aspect embodied in the DRGs has less impact on explaining charge variation. For lung and colon cancer, however, it appears that, overall, the DRGs are performing adequately in explaining resource variation.

o The purpose groups were able to achieve some improvement in variance explained over the DRGs for the lung cancer and breast cancer cases (increase in R squared 3.4 percent and 2.6 percent, respectively) but not for colon cancer.

- Despite their modest contribution to overall R-squared, the purpose groups had significant impacts for DRG 410 (chemotherapy) and the medical malignancy DRGs. Cases classified into DRG 410 which were placed into active treatment with diagnostic evaluation category had consistently higher costs than those placed in the other major purpose group for 410, active treatment without diagnostic evaluation. Only accounting for roughly only 10 percent of cases in DRG 410 for each cancer, the extra diagnostic services delivered during these admissions caused significant increases in cost. Similarly, cases in medical malignancy DRGs have higher resource costs when the purpose of admission is coded into an active treatment category than when the admission is for diagnostic evaluation only or for palliation.

- The medical chart review results show that important information which is significantly related to resource use is now not available on the hospital discharge abstract. For two of the cancers studied (lung and colon) the initial admission was more expensive than subsequent admissions. While not true for breast cancer, this finding may hold for other cancers or for cancer discharges as a whole.

The major policy implication raised by this study concerns the possible inequitable distribution of purpose of admission across hospital types of cases assigned to the same DRG. This study has demonstrated that in two important instances, chemotherapy and medical malignancies, resource costs vary by purpose of admission. This study has also provided preliminary

evidence of hospital differences across the purpose of admission classifications. Further study is warranted to investigate the relationships between DRG grouping, purpose of admission and hospital type.

INTRODUCTION

Malignant neoplasms, cancers, impose a huge burden at many levels. Cancer is the second leading cause of death in the U.S. Individuals with cancer must often bear pain, uncertainty, reduced quality of life, restricted activity, limited productivity and high out-of-pocket expenses related to medical care. Society's burden includes the costs of medical care, morbidity, disability, and premature mortality, as well as absorbing the emotional trauma of individuals and families. Social resources are also required for prevention, research, and detection (Rice, 1988).

The term "cancer" encompasses a diverse group of diseases characterized by uncontrolled growth and the spread of abnormal cells affecting many different body systems. More than five million Americans currently have a history of cancer. Almost two-thirds of them were diagnosed five or more years ago and thus can be considered cured. Almost one million people were newly diagnosed with cancer in 1987, and half are expected to survive five years after diagnosis and treatment. This contrasts with a 20 percent five-year survival rate after treatment in the 1930's (American Cancer Society, 1987).

Economic Costs

Second only to cardiovascular disease, cancer accounts for about one-fourth of all deaths in the U.S., or 461,563 deaths in 1985. (National Center for Health Statistics, 1987). The total economic costs of cancer in 1985 were estimated at $72.5 billion, comprising 10.7 percent of the economic costs of all illness in the U.S. in that year. Direct health care costs were $18.1 billion, 25 percent of the total. Costs related to cancer morbidity (i.e., lost labor output from ill people) were 10 percent of the total, while mortality costs (i.e., lost productivity due to premature death) were 65 percent (Rice, 1988).

Unfortunately, the age-adjusted national death rate from cancer has risen steadily over the last several years. The rate of death from malignant neoplasms rose from 157 per 100,000 population in 1950 to 171 in 1985 (National Cancer Institute, 1988). Rising lung cancer death rates are the major reason for this increase, accounting for 27.6 percent of deaths from all cancers in 1985 (National Center for Health Statistics, 1987). Age-adjusted death rates for all other types of major cancers are levelling off and are declining in some cases. Due to several factors, most notably the aging of the population, cancer incidence is expected to increase over the next 40 to 50 years so that by the year 2030, the number of new cases will double (Janerich, 1984).

Impact on Medicare

The projected increase in cancer incidence and concomitant costs will have an enormous impact on the Medicare program. Currently Medicare pays the majority of cancer care for the aged; the Third National Cancer Survey in 1985 found that Medicare paid expenses in nearly 88 percent of cancer cases in patients over 65 years of age. In 1986, approximately 8 percent of all Medicare discharges were related to cancer. Total cancer-related expenditures for inpatient care paid for by Medicare in 1986 were over $5 billion (Scheffler and Phillips, 1988).

How Medicare pays for inpatient cancer care has become a matter of intense interest and scrutiny by providers, patient advocacy groups, researchers, and policy-makers. The Prospective Payment System (PPS), enacted in 1983, seeks to contain the growth in hospital costs by paying hospitals at a predetermined rate for each discharge, according to which Diagnosis Related Group (DRG) the discharge is assigned. As with other diagnoses, assignment of most cancer cases to DRGs begins by separating surgical from medical cases. Surgical cases are then generally grouped into DRGs according to the type of operation. Therefore, cancer cases are often classed with other patients undergoing the same procedure but for different reasons. Most medical cases are grouped into "neoplasm" DRGs, but these classes often contain benign as well as malignant tumors. An important exception involves medical cases receiving chemotherapy, who are all assigned to DRG 410 regardless of their cancer type. Thus, most cancer cases are assigned to clinically heterogeneous DRGs.

A major policy goal of the DRG payment policy is to avoid any possible incentive for providers to discriminate against patients with particular diseases by paying enough to provide access to good quality care. (Jencks, 1988). As will be discussed below, questions have been raised concerning the adequacy and fairness of payment under DRGs for certain types of cancer care.

Project Goals

The purpose of this project was to examine how well the DRG system performs in grouping cancer-related discharges and to investigate an alternative grouping method: grouping by purpose or reason for admission. We developed a "purpose of admission" typology and tested it using both administrative data from the MEDPAR file and primary data from a medical chart abstraction study.

The project had three major components, as follows:

1) Describe how cancer is classified in the DRG system;
2) Compare grouping discharges by anatomic site of cancer with DRG grouping; and
3) Develop and test a grouping typology based on purpose of admission.

These components are described below.

Cancer and DRGs--

While learning how the DRGs classify cancer diagnoses and surgical procedures related to cancer treatment is fairly straightforward, little information is available about which DRGs contain the largest number of cancer-related discharges. Also unknown is how resource use differs between cancer-related and non-cancer related discharges in "mixed" DRGs, i.e. those DRGs that contain both malignancies and other types of conditions. The first part of this research project was concerned with providing this type of descriptive information.

Grouping by Anatomic Site of Cancer--

Most cancer-related discharges are grouped into mixed DRGs. Of the 186 medical DRGs, only 22 contain cancer diagnoses only (i.e., no non-malignant conditions are included). For discharges with the same cancer diagnoses, we investigated how well grouping by principal diagnosis clustered discharges with similar resource intensity and compared these results to those obtained using the DRGs.

Purpose of Admission Typology--

We developed a typology which classified inpatient admissions for three common cancers--lung, colon and breast--according to the purpose of the admission. Six admission categories were developed: admission for diagnostic work-up; admission for major surgery with diagnostic work-up; admission for major surgery without diagnostic work-up; admission for active treatment with diagnostic work-up; admission for active treatment without diagnostic work-up; and admission for terminal/palliative care. We applied this typology to administrative data from the MEDPAR file and data gathered through medical chart abstraction from five Boston area hospitals. For the chart abstraction study, we expanded the typology to include initial and subsequent admission in each of the six categories. We compared the ability of the purpose of admission typology to explain variations in resource use with the explanatory power of the DRGs.

Organization of Final Report

This final report on the completed project is organized as follows:

- Description of casemix measurement for cancer care;
- Review of clinical issues in cancer care;
- Distribution of cancer-related Medicare discharges by diagnoses;
- Grouping cancer discharges by cancer type vs DRGs;
- Grouping cancer discharges by purpose of admission using administrative data;
- Grouping cancer discharges by purpose of admission using medical chart data; and
- Policy implications of findings.

One major goal of the DRG payment system is to group cases with similar costs. The cost homogeneity of the DRGs, however, has been criticized. Mitchell et al. (1985) analyzed Medicare Part B claims from four states. She found that the coefficient of variation (c.v.) was relatively low for surgical DRGs. For medical DRGs, however, the c.v. was much larger, indicating a significant degree of variability in costs. She also found that DRGs explain five to nine times more of the difference in physician-related costs for the surgical DRGs than for the medical DRGs.

This issue is an important concern with regard to oncology cases, where much of the care is medical. Iezzoni and Moskowitz examined (1984) Medicare claims for DRG 82 (Respiratory Neoplasms). This DRG contains 39 separate ICD-9 codes, classifying neoplasms as either malignant or benign; as primary or secondary[1]; and according to the specific site within the respiratory system where the tumor is found. In the two states they studied, these researchers found that the c.v. for Part A was 1.0320 in New Jersey and 1.2310 in North Carolina, a finding "similar to those for DRGs pertaining to other malignancies." C.V.'s for Part B were 0.8400 in New Jersey and 1.0620 in North Carolina.

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[1] A primary cancer in an organ system is a tumor which originates in that organ system. For example, a primary lung cancer is a cancer which developed in lung tissue. A secondary cancer is a tumor which has metastasized to a particular organ system from another site. For example, a colon tumor which has metastasized to the lung represents a secondary malignancy of the lung, but a primary malignancy of the colon.

Other DRGs which contain large numbers of cancer cases also exhibit high unexplained cost variance. In addition to DRG 82, others with the problem include DRGs 148 and 149 (Major Small and Large Bowel Procedures); DRGs 403, 404, and 405 (Lymphoma and Leukemia); and DRG 400 (Lymphoma and Leukemia with Major Operating Room Procedure) (Mortenson and Yarbro, 1985).

Several factors have been suggested as possible explanations for this high cost variability:

- The ICD-9-CM system of classifying diagnoses which forms the basis of the DRG's codes cancer based on anatomical site, rather than the type of cancer cell morphology. However, cancer cell morphology drives the therapeutic approach.
- Cancer manifests itself at different stages of the disease, each demanding different resources for treatment.
- Many aspects of cancer therapy are discretionary and controversial.
- Practice patterns vary widely among physicians and hospitals.

Hospital Responses to PPS

PPS and the rising costs of cancer care have made hospital administrations and staff more sensitive to the charges incurred by cancer patients. Before expanding oncology services, hospitals are increasingly using "product line management" techniques to determine which products or services to expand or contract. This technique uses cost data to determine which DRGs are "winners" (payments greater than actual costs) and which are "losers" (payments less than actual costs). Products or service lines can be developed that are targeted to patient types in the winning DRGs (Scheffler and Phillips, 1988).

A DRG "winners and losers" analysis was conducted by the Association of Community Cancer Centers (ACCC), an organization whose members manage the care of 25 percent of all new cancer cases in the U.S., using cost data from 20 member hospitals with bed-size of 300 or more (Rice, 1988). The biggest "loser" was DRG 410, chemotherapy, one of the most common DRGs into which cancer patients are admitted. It appears that chemotherapy payment rates are too low because when the DRG payment weights were developed, the data used to develop the weights included lower cost, less ill patients who are now being treated as outpatients. As the weights are recalibrated, this problem will resolve, but because of delays in the data used to compute the new weights, it may take several years to "catch" up to changes in clinical practices. In the meantime, disturbing anecdotal evidence suggests that chemotherapy dosage levels are being reduced to allow outpatient administration which is paid for outside the strictures of PPS. These lower doses may not be optimal for patients, whose course of treatment is prolonged and who may have been able to tolerate higher, more potent doses in the inpatient setting. Likewise, treatments that tend to increase the length of stay in DRG 410--for example, therapies in which the chemotherapeutic drugs are slowly infused into patients--are discouraged under PPS. (Mortenson and Yarbro, 1985).

Hospitals may also face disincentives to participate in clinical trials for testing new cancer therapies. Patients on clinical trials are believed to more expensive than other patients due to increased monitoring, testing and lengths of stay. Objective evidence on the extra costs of clinical trials is unavailable, however (Jencks, 1988).

Finally hospital use of innovations for cancer care that improve efficacy of treatment or increase patient comfort may be discouraged under PPS. The costs of these innovation, such as implantable pumps for chemotherapy administration, would not have been considered in the original calculations of PPS weights. Although recalibration of the weights should address some of these problems over time, hospitals may not accept new treatments as quickly as in the pre-PPS period.

While this study does not address hospital responses to PPS for cancer care, part of the original motivation of the study came from reports of frustration about the ability of the DRG-based PPS to fairly and adequately pay for cancer care. We do, however, examine how hospital characteristics (e.g., bed-size, auspice, and location) are related to cost and utilization differences among patients admitted for different purposes.

Alternatives to DRG's

Due to the observed high within-DRG variability of medically treated patients and the reported numerous concerns of the hospital industry, alternatives to the DRGs have been proposed. Jencks (1987) discusses three factors not considered by the DRGs that may have particular relevance for cancer care: severity of illness, intensity of care and purpose of admission. Possible modifications to the DRGs and/or alternative grouping methods are based on these factors.

Severity of Illness--

Intuitively, severity of illness is an appealing factor to account for unexplained cost variation. The DRG's are based on ICD-9-CM diagnoses, and patients with very different severity of illness can receive identical principal discharge diagnosis codes. At least one study indicates that cancer patients exhibit widely varying degrees of illness severity (Iezzoni et al., 1988). Different types of hospitals were also found to treat patients of different average severity. The same study found that the explanatory power of 40 cancer-related DRG's for cost variation increased significantly when DRG's were subdivided by severity of illness and procedure type.

The extent to which severity of illness is related to resource intensity of treatment is controversial, however. Horn and Sharkey's findings have not been validated by any further work. Numerous researchers are working on severity or "risk" adjustment mechanisms for the DRG's but current evidence indicates that unmeasured admission severity of illness may be responsible for only a small portion of cost variation among individual cases and an even smaller proportion of variation in average cost per case among hospitals (11% in Jencks and Jencks).

Intensity of Care

Patients with similar cancer diagnoses, severity of illness and prognoses may be treated quite differently depending upon the practice style of the admitting hospital and physician(s). Patients themselves also have different goals for their cancer therapy, leading them to seek different treatment settings. It is widely believed that patients in cancer referral centers are managed more aggressively than similar patients treated in community hospitals. The availability of sophisticated diagnostic and therapeutic services in these centers, coupled with a greater inclination towards research are most likely responsible for the higher intensity of care rendered. Currently, no evidence exists suggesting that care in cancer referral centers is under-reimbursed through the DRG system. Furthermore, it is not known whether the more aggressive treatment styles practiced in these facilities translates into better quality of care for patients.

Purpose of Admission--

Grouping discharges based on purpose of admission may have particular relevance for cancer-related care. Cancer treatment has phases: admissions with similar diagnoses, severity of illness levels, and prognoses can have markedly different costs based on why the patient was admitted. Perhaps the most striking contrast is given in the example of two patients, both with terminal lung cancer. One may wish to be treated aggressively, exploring every option including surgery and the use of experimental chemotherapies.

The other may desire to be receive only care related to pain management. Costs between these two patients will vary markedly, even though both would have the same principal diagnosis and could be discharged in the same DRG (depending on the procedures performed).

In this study, we explore the ability of a purpose of admission typology to cluster cancer-related discharges with similar resource intensity in three common cancers--lung, colon and breast. We also investigate how much explanatory power is added to the DRG's when combined with purpose of admission. Before turning to the study questions and technical approach, an understanding of the clinical issues related to treatment of lung, colon and breast cancer is helpful in providing insight into why grouping by purpose of admission may be fruitful.

REVIEW OF CLINICAL ISSUES

"Cancer" is not a single disease. The clinical course, prognosis, and therapeutic approach differs widely depending on the organ system in which the malignancy arose and the cell type of the tumor. As a result, the patterns of hospitalizations, choice of medical versus surgical treatment modalities, and other indicators of resource use will vary across diseases. To understand the reason for some of these differences across the malignancies included in this study, it is important to appreciate the clinical issues raised by lung, colon and breast cancers.[2]

Lung Cancer

Lung cancer is the most common cause of cancer deaths among American men and women. According to the Centers for Disease Control, in 1986, 126,000 American died of lung cancer; more than 60 percent of these deaths were among individuals greater than 64 years of age, and 80 percent of lung cancer deaths were linked to cigarette smoking. Lung cancer death rates are higher in the South and lower Midwest that in other parts of the country.

Depending on the microscopic appearance and behavior of the malignant lung tissue cell, lung cancer can be divided into two types: (1) non-small cell lung cancer, which includes squamous cell, adenocarcinoma, and large cell cancers, and accounts for about 80 percent of lung tumors; and (2) small cell lung cancer, which includes the remaining 20 percent of tumors. Non-small cell lung cancer can potentially be treated surgically. Of patients presenting with this form of tumor, around half will be diagnosed early enough for surgery to be considered. These patients will undergo surgery in hope of significant palliation if not a cure. However, in approximately three-quarters of non-small cell lung cancer patients, no chance of surgical cure exists. Chemotherapy and radiotherapy are administered for certain manifestations of this disease, but the patients generally have poor prognoses. Almost all (over 90 percent) will be dead within five years.

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[2] Treatments for cancers undergo constant scrutiny and study by the research and practitioner community, and standards change over time. Details of practice also vary from institution to institution, and across regions. Therefore, the summary offered here is provided to give some general sense of the clinical issues involved with these diseases, not necessarily to represent the "state-of-the-art" in cancer therapy.

For the other 20 percent of patients with small-cell lung cancer, surgery is not an option (i.e., the tumors are not amenable to surgical resection). Chemotherapy and radiation therapy are the only treatment modalities available for this disease, and patients have only a 20 percent 2-year survival rate.

When chemotherapy is administered for lung cancer, it is generally provided in the inpatient setting. The chemotherapeutic regimens are often highly toxic, and the patients require close monitoring both during and following administration of the drugs. For example, the drug cis-platinum, a common chemotherapeutic agent for lung cancer, is highly toxic to the kidneys, and the patients require continuous hydration and monitoring which is most safely provided in the inpatient environment.

Surgery can also be used not for curative purposes, but in an attempt to palliate the consequences of local tumor invasion or the effect of distant metastases. For example, the lung mass may erode into a blood vessel causing massive bleeding which requires surgical repair, or a bone metastasis may impinge on the spinal cord, requiring surgical decompression. The most common sites of distant metastases for lung cancer are bone, liver, adrenal, and brain, although the patterns of metastases vary by tumor cell type. Thus patients may be hospitalized in many different DRGs beyond those indicating respiratory conditions.

Colon Cancer

Colon cancer is a common malignancy, occurring in 6 percent of American men and 5 percent of women. It is a disease which is generally treated surgically, with a significant chance for a cure. About 80 percent of patients will receive surgical resection of their tumor as their initial treatment, and the chance of cure depends on the extent of the disease. Virtually all patients with Stage A colon cancer will be cured by surgery, while 80 to 90 percent of those with Stage B cancer and 30 to 50 percent of those with Stage C cancer will be cured. If there is no evidence of tumor following surgery, there is little role for additional treatment with radiation of chemotherapy.

The remaining 20 percent of patients are not surgical candidates or may receive surgery in hope only of palliating the disease, not curing it. These patients, as well as those with recurrent cancer following an initial surgery, are often offered chemotherapy but the performance of chemotherapy in ameliorating colon cancer has been disappointing to date Unlike in lung cancer, the chemotherapeutic regimens for colon cancer are generally well-tolerated, and may be administered in the outpatient setting. However, the treatment typically does little to prolong survival. Radiation therapy is also provided in certain situations.

Surgery is often needed for a common complication of recurrent colon cancer -- intestinal obstruction and/or perforation. The most common sites of metastases are the liver and lung, but surgery is rarely performed for these metastatic tumors. Despite this, colon cancer patients can be admitted for medical complications in these other organ system and therefore appear in DRGs other than those related strictly to the gastrointestinal tract.

Breast Cancer

In the 1980s breast cancer was surpassed by lung cancer as the leading cause of death from malignancy among American women. Although it is now the second leading cause of cancer deaths, breast cancer is a very common condition, afflicting approximately one in 14 American women. In the majority of cases, initial treatment is surgical with the potential for cure relating to tumor size and extent of lymph node involvement. Around 70 percent of patients will present with Stage I or II disease and undergo surgery, with an 80 percent chance of cure. Two types of surgical approaches are currently popular, either a modified radical mastectomy or a lumpectomy followed by outpatient radiation therapy (the schedule for the outpatient radiation is fairly rigorous, prompting some women to choose the modified radical approach). There is increasing evidence that adjuvant chemotherapy following these surgeries improves the chance of cure.

About 30 percent of women will present with Stage III or IV breast cancer, will little hope of cure. Despite this, they may undergo surgical excision of the tumor, followed by radiation and chemotherapy. Only half of these patients will respond to these treatments, but virtually all will relapse and die from their cancer. As with colon cancer, chemotherapeutic regimens in breast cancer are generally well tolerated, and can be administered in an outpatient setting.

Metastases can occur months to decades following the initial presentation with breast cancer. Chemotherapy, radiation treatments, and surgery may be required to care for complications relating to metastases. The most common metastatic sites are lung, liver, brain and bone. Therefore, breast cancer patients may be included in a wide range of DRGs.

Summary

The three cancers included in this study have different behaviors, prognoses, and metastatic patterns, and they thus require different therapeutic approaches. These differences can be summarized as follows:

- Colon and breast cancer are more likely than lung cancer to be treated by surgery. They also have a better chance of cure through this surgery -- a single surgical admission may be all that is required over the courses of these diseases.

- Chemotherapy for lung cancer is often highly toxic and poorly tolerated. It thus is frequently administered in the inpatient setting. In contrast, chemotherapy for colon and breast cancer is generally well tolerated, and is thus often provided in an outpatient environment.

- There is more evidence of a role for post-surgical chemotherapy in breast than in colon cancer.

- For all cancers, surgery may be required to deal with complications from metastases. The patterns of metastases differ across the cancers, so that the DRG assignments may also vary across the three diseases.

With this review of clinical issues as background, we now turn to an examination of how Medicare cancer-related discharges are clustered by the DRGs. First, the principal diagnoses of cancer-related discharges are examined. Second, a comparison is made between clustering discharges by anatomic site of cancer and by DRG for selected high volume cancers.

DISTRIBUTION OF CANCER-RELATED MEDICARE DISCHARGES BY DIAGNOSIS

A preliminary analysis of the FY1984 MEDPAR file was conducted in an effort to describe the distribution of cancer-related discharges for the Medicare population by principal diagnosis. The main research questions for this analysis were:

- What are the major principal cancer diagnoses for which the Medicare population is hospitalized?
- What are the most common types of cancer for which the Medicare population is hospitalized?

Methods

A 20 percent sample of the FY1984 MEDPAR file for patients 65 and over was obtained, containing a total of 1,987,179 discharges. The data were cleaned to remove two types of records. First, 217,352 records from long term care hospitals were eliminated. An additional 3,688 records were removed from the file because charges were missing. The final number of discharges in this analysis file, after cleaning, was 1,766,139.

Cancer-related discharges were defined by using the following ICD-9-CM codes:

140.0-208.9	Malignant neoplasms
230.0-239.9	Carcinoma in situ and neoplasms of uncertain and unspecified behavior

V10.0-10.9	Personal history of malignant neoplasm
V52.4	Fitting and adjustment of breast prothesis
V58.0	Radiotherapy session
V58.1	Maintenance chemotherapy
V66.1	Convalescence following radiotherapy
V66.2	Convalescence following chemotherapy
V67.1	Follow-up examination following radiotherapy
V67.2	Follow-up examination following chemotherapy
V71.1	Observation for suspected malignant neoplasm

Analysis of this file showed that 173,522 (9.8%) of the discharges had a cancer-related ICD-9-CM code in the principal (i.e., first-listed) diagnostic position. About half (85,641) of these records also had a secondary cancer-related diagnosis. An additional 102,024 (5.8%) of discharges had cancer as a secondary diagnosis only.

Results

Table 1 presents the fifteen leading principal diagnoses for cancer discharges in the sample file. Over three quarters of the discharges with cancer as a principal diagnosis were represented by 15 diagnoses. This is somewhat misleading, however, since four of these principal diagnoses do not identify the anatomic site of cancer. Chemotherapy, for example, is the second most common principal "diagnosis" with 18,062 discharges.

Since a major purpose of this analysis was to identify common cancer types for more in-depth study, it was important to identify the primary site

Table 1

The Fifteen Leading Principal Diagnoses for Cancer Discharges: FY1984 MEDPAR File

ICD-9-CM Code	Description	Number of Cases
162	Lung cancer	19,161
V58.1	Admission for chemotherapy	18,062
185	Prostate cancer	15,983
153	Colon cancer	13,406
198	Metastases to specified site other than lung or digestive system	11,890
174	Breast cancer	11,297
197	Metastases to lung or digestive system	10,993
188	Bladder cancer	10,885
154	Rectal cancer	6,450
157	Pancreatic cancer	3,799
182	Cancer of body of uterus	3,361
151	Stomach cancer	3,064
199	Metastases to unspecified area	2,876
202	Malignant lymphoma	2,653
	Total discharges accounted for by 15 leading diagnoses	133,850
	Total discharges with a principal diagnosis of cancer	173,522
	Percent accounted for by leading 15 diagnoses	77.1%

of cancer for each discharge. For discharges that had chemotherapy coded in the principal diagnosis position, the second listed diagnoses was used to classify the type of cancer. A primary site of cancer was also assigned to the remaining discharges that did not have a primary site of cancer coded in the principal diagnosis position using input from our oncology clinical consultant, Dr. Steven Come. Table 2 shows the fifteen leading primary sites of cancer for oncology discharges and provides the mean and total charges for these discharges. About three quarters of the discharges with cancer as a principal diagnosis on the MEDPAR file are accounted for by 15 primary cancer sites. The four most common sites are lung, prostate, colon, and breast, accounting for almost 43 percent of discharges and almost 45 percent of total charges.

GROUPING MEDICARE CANCER-RELATED DISCHARGES BY ANATOMICAL CANCER SITE vs DRGs

This portion of the analysis investigates how Medicare cancer-related discharges are categorized by the DRGs. The amount of cost variation in discharges "explained" by the current DRGs was compared to the amount explained when the cancer-related discharges were grouped by primary cancer site. The major research questions that this analysis addressed were:

- o Which DRGs account for the majority of cancer discharges?
- o Does the ability of the DRGs to explain cost variation improve when discharges are grouped by anatomical site of cancer within DRGs?

Table 2

The Fifteen Leading Primary Sites of Cancer for Cancer Discharges: Twenty Percent 1984 MedPar File for the 65 and Over Population

CD-9-CM Code	Description	Number of cases	Mean charges(2)	Total charges in millions
62	Lung cancer	26,178	$ 6,038	$ 158.1
85	Prostate cancer	18,642	4,477	83.5
53	Colon cancer	17,236	8,611	148.4
74	Breast cancer	16,105	4,235	68.2
88	Bladder cancer	11,852	4,459	52.9
54	Rectal cancer	7,421	8,535	63.3
83	Cancer of the ovary	6,421	4,352	27.9
57	Pancreatic cancer	4,268	8,414	35.9
182	Cancer of body of uterus	4,185	4,680	19.6
151	Stomach cancer	3,548	9,771	34.7
202	Malignant lymphoma	3,379	5,954	20.1
189	Malignant neoplasm of kidney	3,055	7,655	23.4
173	Skin neoplasm	2,660	3,137	8.3
200	Lymphosarcoma	2,545	6,464	16.5
203	Multiple myeloma	2,380	6,182	14.7
Total discharges accounted for by 15 leading diagnoses		127,495	5,971	775.0
Percent accounted for by leading 15 diagnoses		74.9%		
Other primary diagnoses of less common cancers		31,934(1)	5,604	179.0
No primary cancer on record		11,713	5,917	69.3
Total discharges with a primary diagnosis of cancer		173,522	$ 5,900	$ 1,023.8

(1)Of these, the most common are myeloid leukemia and cancer of the larynx

(2)Untrimmed

Table 3
DRGs Ranked by Frequency of Discharges with a Primary Cancer Diagnosis

Rank	DRG	Label	# Of Discharges with a Primary Cancer Diagnosis	% Of All Discharges with a Primary Cancer Diagnosis	# With a Primary Cancer Diagnosis Only	# Of Discharges with a Primary & a Secondary Cancer Diagnosis	# Of Discharges with a Secondary Cancer Diagnosis Only	# Of Discharges with No Cancer Diagnoses	Total # of Discharges	% of Total Discharges
1	82	Respiratory neoplasms	19,033	11.0	8,510	10,523	4	52	19,089	1.1
2	410	Chemotherapy	17,991	10.4	816	17,175	49	22	18,062	1.0
3	148	Major small and large bowel procedures over age 60 or with c.c	11,655	6.7	6,521	5,134	1,468	8,533	21,656	1.2
4	403	Lymphoma or leukemia with minor O.R. procedure over age 69 or with c.c.	8,523	4.9	6,963	1,560	32	182	8,737	0.5
5	172	Digestive malignancy over age 69 or with c.c.	8,501	4.9	4,134	4,367	0	1	8,502	0.5
6	336	Transurethral prostatectomy over age 69 or with c.c	7,472	4.3	6,005	1,467	1,426	21,316	30,214	1.7
7	310	Transurethral procedures over age 69 or with c.c.	6,931	4.0	5,418	1,513	675	2,969	10,575	0.6
8	257	Total mastectomy for malignancy over age 69 or with c.c.	6,858	4.0	4,212	2,646	0	0	6,858	0.4
9	203	Malignancy of hepatobiliary system or pancreas	6,271	3.6	2,302	3,969	0	0	6,271	0.4
10	239	Pathological fractures and musculoskeletal and connective tissue malignancy	4,925	2.8	811	4,114	846	5,546	11,317	0.6

Table 3 (Continued)
DRGs Ranked by Frequency of Discharges with a Primary Cancer Diagnosis

Rank	DRG	Label	# Of Discharges with a Primary Cancer Diagnosis	% Of All Discharges with a Primary Cancer Diagnosis	# With a Primary Cancer Diagnosis Only	# Of Discharges with a Primary & a Secondary Cancer Diagnosis	# Of Discharges with a Secondary Cancer Diagnosis Only	# Of Discharges with No Cancer Diagnoses	Total # of Discharges	% of Total Discharges
11	413	Other myeloproliferative disorder or poorly differentiated neoplasm diagnosed over 69 or with c.c.	3,946	2.3	1,085	2,861	9	48	4,003	0.2
12	346	Malignancy, male reproductive system, over age 69 or with c.c.	3,774	2.2	1,890	1,884	0	1	3,775	0.2
13	75	Major chest procedures	3,690	2.1	2,184	1,506	218	1,116	5,024	0.3
14	10	Nervous system neoplasms, over age 69 or with c.c.	3,202	1.8	1,143	2,059	15	381	3,598	0.2
15	146	Rectal resection over age 69 or with c.c.	2,742	1.6	1,661	1,081	93	695	3,530	0.2
16	303	Kidney, ureter and major bladder procedure for neoplasm	2,466	1.4	1,691	775	1	32	2,499	0.1
17	468	Unrelated or procedure	2,429	1.4	1,017	1,412	3,526	1,901	24,968	1.4
18	354	Non-radical hysterectomy over age 69 or with c.c.	2,388	1.4	1,670	718	143	3,681	6,212	0.4
19	318	Kidney and urinary tract neoplasms over age 69 or with c.c.	2,252	1.3	1,266	986	5	24	2,281	0.1
20	338	Teates procedures, for malignancy	1,985	1.1	961	1,024	0	0	1,985	0.1

Table 3 (Continued)
DRGs Ranked by Frequency of Discharges with a Primary Cancer Diagnosis

Rank	DRG	Label	# Of Discharges with a Primary Cancer Diagnosis	% Of All Discharges with a Primary Cancer Diagnosis	# With a Primary Cancer Diagnosis Only	# Of Discharges with a Primary & a Secondary Cancer Diagnosis	# Of Discharges with a Secondary Cancer Diagnosis Only	# Of Discharges with No Cancer Diagnoses	Total # of Discharges	% of Total Discharges
21	154	Stomach, esophageal and duodenal procedures over age 69 or with c.c	1,954	1.1	858	1,096	554	5,883	8,391	0.5
22	366	Malignancy, female reproductive system over age 69 or with c.c	1,702	1.0	817	885	0	2	1,704	0.01
23	64	Ear, nose and throat malignancy	1,606	1.0	1,004	602	0	0	1,606	0.01
24	259	Subtotal mastectomy for malignancy over age 69 or with c.c.	1,500	1.0	1,040	460	0	0	1,500	0.01
25	258	Total mastectomy for malignancy under age 70 without c.c	1,401	1.0	1,294	107	0	0	1,401	0.01
		Total		77.9						14.8

Methods

The first step in this analysis was to develop criteria for determining which DRGs contained a significant number or proportion of cancer-related discharges and would therefore be affected by regrouping. We dropped DRGs from the analysis if both of the following conditions were met:

1. The total number of cancer-related cases was less than 100; and
2. Less than 50 percent of the cases were cancer-related.

Using these criteria, 241 low-volume DRGs were deleted from the analysis, representing only 9 percent (158,542) of total discharges. The 229 selected DRGs contained 91 percent of the total discharges on the MEDPAR file.

Results

For analytic purposes, the leading cancer DRGs were defined as DRGs with the most discharges with a principal cancer diagnosis. This definition was used because preliminary analysis showed that, except for three DRGs, discharges coded with a secondary cancer diagnosis only were likely to contain a "history of cancer" diagnosis that did not appear to substantially affect the treatment given the patient. Table 3 shows the 25 leading DRGs. The leading 25 cancer DRGs accounted for almost 78 percent of all discharges with a primary cancer diagnosis. Thus, patients with primary cancer diagnoses were clustered in a relatively small number of DRGs. These DRGs, however, make up less than 15 percent of the total discharges. This indicates that regrouping cancer diagnoses may substantially alter a few DRGs but have few system-wide effects.

The most common primary cancer sites were analyzed by major DRGs to investigate the effect of grouping by primary site on the ability of DRGs to explain cost variation. Figures 1, 2, and 3 display the results of these analyses for lung, colon, and breast cancer.

For lung cancer, the most common DRGs -- the medical treatment of malignant lung neoplasms (DRG 82), chemotherapy for lung cancer (DRG 410), and major chest procedures (DRG 75) -- have significantly different mean charges ($4,705 for medical treatment of lung cancer, $2,043 for chemotherapy for lung cancer, and $12,618 for major chest procedures) and better c.v.'s (0.84, 0.59, and 0.67) than the overall mean and c.v.'s for all Medicare discharges with a diagnosis of neoplasm of the lung as the primary site of cancer. Improvements in the c.v.'s were also noted when breast cancer discharges were grouped by DRGs. The improvement in the c.v.'s was less pronounced when the same analysis was conducted for colon cancer discharges.

Next, we examined impact on cost variation of grouping discharges by anatomical site of cancer or type of diagnosis within DRG for those DRGs that contain both cancer and non-cancer diagnoses -- mostly surgical DRGs. It was hypothesized that by separating the cancer discharges from the non-cancer discharges within surgical DRGs, the ability of the DRGs to explain cost variation would be improved. Figure 4 indicates that transurethral procedures (DRG 310) on the bladder appear to cost about the same and have similar coefficients of variation whether the procedure is performed for a patient with cancer or with another diagnosis. Figure 5 shows that transurethral prostatectomies (DRG 336) cost somewhat more ($4,186) when the procedure is performed for prostate cancer than when it is performed for hyperplasia of the prostate ($3,708) but the coefficients of variation are similar (.54 for malignant neoplasm of prostate vs. .51 for hyperplasia of prostate). For major large and small bowel procedures (DRG 148), shown in Figure 6, the colon and rectum cancer discharges ($10,789 and $11,065) are considerably less expensive than the non-cancer discharges (intestinal obstruction $13,329; diverticula of intestine - $11,872; vascular insufficiency of intestine - $16,687). The coefficients of variation however are only slightly lower for the cancer discharges compared to the non-cancer discharges.

The conclusions from these preliminary analyses of the FY1984 MEDPAR file indicate that grouping discharges by primary site of cancer within DRG does not improve the ability of DRGs to account for cost variations. The next analysis investigates an alternative grouping method, classifying discharges by purpose of admission.

PURPOSE OF ADMISSION USING ADMINISTRATIVE DATA

We developed a way to classify purpose of cancer admissions within the limitations imposed by the administrative data. We hypothesized that the treatment choices reflected in the therapies and procedures provided to patients would be strongly related to the costs of the admission. We further hypothesized that these categories would be similar across cancers, although the relative proportion of the categories would differ based on most common therapeutic modalities used for treatment as discussed in the earlier section on clinical issues in this report.

Our purpose of admission typology had six categories:

1) admission for major surgery with diagnostic work-up
2) admission for major surgery without diagnostic work-up
3) admission for active treatment with diagnostic work-up
4) admission for active treatment without diagnostic work-up
5) admission for diagnostic work-up only
6) admission for terminal/palliative care

These categories were constructed by grouping the data elements available on the MEDPAR discharge abstract as will be discussed in more detail below.

Research Questions

The typology was used to test the following research questions:

- How does purpose of admission relate to resource use, measured by total charge, length of stay (LOS) and per diem charge?

- Does purpose of admission explain more variation in total charges than DRG's?

- How is purpose of admission related to patient, hospital and regional characteristics?

- Could the DRG's be improved upon by considering purpose of admission, particularly the medical DRG's related to cancer and the chemotherapy DRG (DRG 410)?

Methods

Selection of Cancers--

Lung, colon and breast cancer were selected due to their high incidence and cost in the Medicare population and the differences among them in prognosis, behaviors and therapeutic approaches. In the FY1984 MEDPAR file, lung cancer was coded as the most common primary site (15 percent of cancer-related discharges) and these discharges accounted for the greatest proportion of total charges among all cancers (15 percent or $158.1 million). Colon as a primary site ranked third in frequency with 9.9 percent of total discharges and second in proportion of total charges (14 percent or $148.4 million). Breast cancer as a primary site ranked fourth in frequency and proportion of charges, accounting for 9 percent of discharges and 6.6 percent of total charges ($68.2 million). The prognostic, behavioral and treatment modality differences among these cancers were discussed earlier in the review of clinical issues.

Analysis File Creation--

We obtained the 20 percent sample MEDPAR file from FY1985 and extracted all discharges with lung, colon or breast cancer coded as a listed diagnosis. Preliminary analysis indicated that many discharges with one of the cancers in the third, fourth or fifth position were unrelated to care for the cancer. Thus, we limited the analysis to all discharges with a principal diagnosis of one of the cancers and to discharges with one of the cancers in the second diagnostic position and a diagnosis considered to be a complication of the cancer as a principal diagnosis. The list of complication diagnoses is provided in Appendix A. The resulting analysis file was merged with the Provider of Services (POS) file using provider identification number to add information on the characteristics of the hospitals discharging the patients.

Severity of Illness--

Given the limitations of administrative data, it was impossible to adjust fully for severity of illness in our analyses using the MEDPAR file. However, we attempted to use the available diagnostic data (up to five ICD-9-CM diagnostic codes per hospitalization) to indicate something about the extent and complications of the cancers for which patients were admitted, as well as other comorbidities which might be present. ICD-9-CM diagnostic codes were designated defining the following three classes to serve as proxies for illness severity.

The METASTATIC DISEASE variable was flagged if either the ICD-9-CM codes specified for secondary malignancies (196-198) or the ICD-9-CM codes indicating primary cancers of sites other than the site of interest (lung, colon, or breast) were listed in the second, third, fourth, or fifth diagnostic position. Thus, all codes from 140 through 199.9, except the codes for the specific cancer under study (lung, colon, or breast), were considered indicative of metastatic disease. Although technically most of these other cancer codes are intended to indicate primary malignancies, we found that many hospitalizations had these ICD-9-CM codes listed. While it is certainly possible for lung, colon, and breast cancer patients (particularly those with adenocarcinomas) to have additional primary malignancies originating in other organ systems, statistically it is more likely that the many other cancers coded as primaries actually represent metastatic disease, and were thus miscoded.

Our decision attempts to transcend this probable difficulty with miscoding. However, there may be a limited number of cases in which disease designated by us as metastatic actually represents another primary malignancy.

The COMPLICATIONS variable was flagged if any ICD-9-CM diagnosis in the second, third, fourth, or fifth position indicated conditions which probably represent complications of the cancer under study, its treatment, or its metastases (see Appendix A). Examples of such conditions include pulmonary collapse or hemorrhage, respiratory failure, seizures, coma, cauda equina syndrome (blockage of the spinal canal), persistent vomiting, gastrointestinal hemorrhage, pathological fracture (fracture of a bone at the site of a tumor, probably a metastasis), intestinal obstruction, agranulocytosis (low white blood cell count), and volume depletion. Although a number of these codes will reflect a process unrelated to the patients' cancer, the most probable scenario is that the condition is somehow related to the underlying malignancy. For simplicity, the same list was applied to all three cancers under study.

The COMPLICATIONS/COMORBIDITY variable was flagged if any ICD-9-CM diagnostic codes which appear on the complication and comorbidity list of the

DRGs (the "C.C." list), but were not included among the codes defining the prior two categories, appeared in the second, third, fourth, or fifth diagnostic position. These C.C.'s probably represent other conditions which are unrelated to the patients' cancers. The DRGs include among the C.C.'s those diagnostic codes which have a significant impact on hospitalization costs, in addition to that of the principal diagnosis. Examples of such C.C.'s include diabetes with renal, circulatory, or neurological manifestations, acute myocardial infarction, malignancy hypertension, cholelithiasis with acute cholecystitis (an inflamed gallbladder due to stones), and alcoholic psychosis.

All secondary diagnoses were scanned to assign these classes to an admission. Thus, an admission could contain no indication of complications, or could have one, two, or three types of complications. It is important to emphasize that these lists were created using the judgement of the project staff. Validation by other researchers is important to explore further the methodology.

Development of Typology--

To classify discharges into the purpose of admission typology, we used the information available on MEDPAR on the procedures performed during the admission and the charges for diagnostic (laboratory and radiology) and treatment (intensive care, operating room and inhalation therapy) activities. A small number of ICD-9-CM procedure codes were eliminated from consideration because they represent routine services (e.g., physical examination), items which would not effectively differentiate the purpose of the admission (e.g., routine chest radiograph, red blood cell transfusions, microscopic examination of the urine, venipuncture), or obstetrical services. The remaining ICD-9-CM procedure codes were grouped into the following classes:

The MAJOR SURGERY variable was flagged if the ICD-9-CM procedure list included procedures which typically must be performed in the sterile environment of an operating room or comparable facility, and are generally intended as therapeutic (i.e., rather than diagnostic). A list of these procedures is provided in Appendix B.

The DIAGNOSTIC WORK-UP variable was flagged if the ICD-9-CM procedure list included procedures used primarily for diagnostic reasons. The list of diagnostic procedures used is provided in Appendix C. Note that this list includes several procedures, such as biopsies, that are classified as surgery by the DRG's. Diagnostic work-up was also flagged if the proportion of total charges accounted for by radiology plus laboratory charges was at or higher than the 75th percentile for the entire distribution of discharges for that cancer.

The ACTIVE TREATMENT variable was flagged if the ICD-9-CM procedure list reflected procedures which can potentially be performed at the bedside (e.g., insertion of chest tubes) for therapeutic purposes. It also includes codes indicating chemotherapy or radiation therapy, mechanical ventilation, intensive care unit monitoring, and cardiopulmonary resuscitation. The intent of this category was to indicate the use of treatments which would not ordinarily be employed in patients who had made the decision to suspend aggressive interventions (e.g., as in the presence of a "do not resuscitate" order). Active treatment was also flagged in the presence of intensive care unit, operating room or inhalation therapy charges. The list of active treatments is provided in Appendix D.

Using these three variables, five groups were created: major surgery with diagnostic work-up, major surgery without diagnostic work-up, active treatment with diagnostic work-up, active treatment without diagnostic work-up and diagnostic work-up only. A discharge with none of these variables flagged was classified into the sixth group, terminal or palliative care.[3]

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[3] We are using "palliation" in a very narrow sense, in that active or aggressive therapies are not pursued (e.g., patient admitted purely for pain control.)

Results of Descriptive Analyses

Results for Lung Cancer

Most lung cancer discharges fell into three purpose of admission groups: diagnostic work-up only (37.2% of total discharges); palliation (24.2%) and active treatment without diagnostic work-up (19.3%). This finding is consistent with the most commonly used clinical treatment approaches for lung cancer as discussed in an earlier section of this report.

Tables 4-6 present results of breakdowns of the purpose of admission groups and three measures of resource intensity (total charges, per diem charge and length of stay). Mean total charges for all discharges was $4,882; mean per diem charge was $678; and mean LOS was 8.4. As expected, the two major surgery groups had the highest average total charges (weighted mean = $9,884) and highest average lengths of stay (weighted mean = 12.8 days). The diagnostic work-up group had mean total charges near the mean total charges for all groups ($4,846); mean per diem charge slightly lower than the average for all groups ($655) and mean LOS equal to the group average (8.4). Discharges in the palliation group had average LOS (8.3 days) but relatively low intensity treatment (mean total charges = $3,658 and mean per diem charge = $488). In contrast, discharges in the active treatment without diagnostic work-up group had short stays with high intensity treatment (mean total charges =$3,080, mean per diem charge = $873 and mean LOS = 4.7 days). One-way ANOVAs were performed on each of these resource intensity measures which showed significant differences ($p < .001$) by purpose of admission group. Planned comparisons revealed significant differences among all groups at the .05 level.

Tables 7 and 8 present the relationship between the purpose groups and the DRGs. As shown in Table 7, almost 70 percent of the palliation discharges fell into DRG 82 with the remaining 30 percent distributed equally between other medical DRGs in MDC4 and other medical DRGs in other MDCs. Mean total charges were similar among the three DRG groupings. Roughly two-thirds of the active treatment without diagnostic work-up discharges were grouped into DRG 410, Chemotherapy. Slightly less than one-quarter of these discharges fell into DRG 82 and had mean total charges more than twice as high as the chemotherapy discharges in the active treatment without diagnostic work-up group. Over 70 percent of the diagnostic work-up only group were placed into DRG 82; the 11 percent of discharges in that group placed into DRG 76/77 group had significantly higher average total charges. These results suggest that, except for the palliation group, the DRGs appear to be splitting the purpose groups by resource costs.

Results in Table 8, however, indicate that the purpose groups are also disaggregating DRGs by resource cost. Particularly for DRGs 410 and 82, different purpose groups have clearly different mean charges. The almost 8 percent of cases in DRG410 which fell into the active treatment with diagnostic work-up had mean charges over 50 percent higher than the cases which were grouped into active treatment without diagnostic work-up. Clearly, chemotherapy patients who receive diagnostic tests and procedures cost more per discharge than those who do not. The total costs of these two groups of patients may be similar, however, if outpatient diagnostic costs were included. Similarly, discharges in DRG082 which fell into the palliation group had mean charges only half as high as those in DRG082 in the active treatment with diagnostic work-up group. The multivariate results to be discussed later address the improvement in variance explained in total charges attributable to the purpose groups after controlling for DRG.

Tables 9-11 present results of breakdowns of the purpose groups and patient-related variables. Table 6 displays the breakdown for three age groups: patients age 65-74; age 75-84 and 85 and over. The palliation group had the highest proportion of discharges for patients age 85 and over (5.4%). The lowest proportions of discharges for very elderly patients were found in the major surgery groups (1.6% in major surgery with diagnostic work-up and 1.8% in major surgery without diagnostic work-up) and the active treatment without diagnostic work-up--primarily chemotherapy--group (1.6%). This latter group had the highest proportion of discharges for patients age 65-74 (77.4%). Though the average charges for discharges in the three age groups were similar across all purpose groups, average charges did vary within three of the purpose groups by age. Discharges for younger patients had higher average charges in the two surgery groups while discharges for patients age 85 and over had higher charges in the active treatment without diagnostic work-up--primarily chemotherapy--group.

Table 10 displays the purpose groups analyzed by type of secondary diagnosis (i.e., complication, comorbidity, distant metastases or any combination of the three). The highest proportion of discharges for patients with none of the three types of secondary diagnoses were found in the two surgery groups (13.2% for major surgery with diagnostic work-up and 18.1% for major surgery without diagnostic work-up). These two surgery groups contained the lowest proportions of discharges with secondary diagnoses flagged by all three secondary diagnosis types. Discharges falling into the major surgery groups were more likely to have a comorbid condition flagged and less likely to have complications flagged. Active treatment without diagnostic work-up discharges were most likely to have a complication flagged. The palliation group did not have the highest proportion of discharges with more than one type of secondary diagnosis flagged. This could be due to the phenomenon suggested by Jencks et al. (1988), that if one diagnosis consumes attention during the admission, other diagnoses may get short shrift. While 62.3% of discharges in this group did have more than one type flagged, 67.9% of the discharges in the active treatment with diagnostic work-up group had more than one flagged and 64.2% of discharges in the active treatment without diagnostic work-up group had more than one secondary type flagged. No clear relationship between average charges and secondary diagnosis type was found.

Table 11 shows the relationship between purpose group and discharge status as alive or dead. Overall, 17.8% of cases fell into the discharged dead category. This proportion varied markedly by purpose group from over a third of discharges in the palliation group to approximately 6% in both major surgery groups. Overall, average charges were only 4% higher for discharges in the discharged dead category. Again, however, this difference was pronounced in certain purpose groups. Active treatment with diagnostic work-up discharges discharged dead had average charges 44% higher than those discharged alive; active treatment without diagnostic work-up discharges discharged dead had average charges 104% higher than those discharged alive.

In contrast, palliation cases in the discharged dead category had average charges 3% lower.

The final group of tables, Tables 12-14, display results by purpose group split according to hospital and regional variables. Clear differences by purpose group emerge by hospital bed size (Table 12). More than half (57%) of the palliation discharges were discharged from hospitals under 300 beds--almost 20% of these cases were discharged from hospitals with less than 100 beds. In contrast, discharges in the major surgery and active treatment groups were more likely to have been discharged from hospitals with more than 300 beds. One-third of the active treatment cases with diagnostic work-up were discharged from hospitals with over 500 beds. Average charges were found to be related to bed-size: overall, discharges from the largest bed-size category hospitals had average charges 49% higher than those from the smallest hospitals. This relationship also varied by purpose group. Palliation discharges and diagnostic work-up discharges from 500+ bed hospitals were both approximately 48% more expensive than their counterparts from under 100 bed hospitals. Major surgery cases were actually less expensive in the largest compared to the smallest bed-size category.

Table 13 displays discharges by purpose group and hospital control (i.e., not-for-profit, proprietary or public). Overall, 14.3% of discharges were from public hospitals. For palliation discharges, however, this proportion rose to 18.7%. Major surgery discharges were less likely to be from public hospitals and more likely to be from not-for-profit institutions. Proprietary hospitals had a slightly higher proportion of discharges in the diagnostic work-up only group. Proprietary hospitals had the highest average charges--24% higher than public hospitals' average charges. This finding held across all of the purpose groups.

In Table 14, discharges are aggregated by Metropolitan Statistical Area (MSA) type (urban and rural) and purpose group. Overall, 82.7% of discharges were from hospitals located in urban areas. This proportion varied by purpose group. Palliation discharges from rural hospitals were relatively more common (28.0%) while major surgery and active treatment discharges were relatively less likely to be from rural hospitals (both approximately 12% of discharges in these purpose groups). Urban discharges had average charges that were 38 percent higher than rural discharges. The urban-rural difference in average charges was the most pronounced for palliation discharges (32% higher in urban areas) and diagnostic work-up only discharges (41% higher in urban areas).

Results for Colon Cancer

The majority of the colon cancer discharges fell into three purpose of admission groups: major surgery without diagnostic work-up (41.9%), major surgery with diagnostic work-up (26.2%), and diagnostic work-up only (15.8). As with lung cancer, this finding is consistent with the most commonly used clinical treatment approaches for colon cancer as discussed in an earlier section of this report.

Tables 15-17 present results of the purpose of admission groups by three measures of resource intensity (total charges, per diem charge and length of stay). Mean total charges for all discharges was $7,730; mean per diem charge was $645; and mean LOS was 12.5. As expected, the two major surgery groups had the highest average total charges (weighted mean = $9,549) and highest average lengths of stay (weighted mean = 14.4 days). The diagnostic work-up group had substantially lower mean total charges than for all groups ($3,902); mean per diem charge lower than the average for all groups ($544) and mean LOS lower than the group average (7.9). Discharges in the palliation group had an average mean LOS of 10.2 days with relatively low intensity treatment (mean total charges = $3,736 and mean per diem charge = $404). Interestingly, discharges in the active treatment without diagnostic work-up group had comparatively shorter than average stays and mean total charges with about average mean per diem charges (mean LOS = 6.5 days, mean total charges =$3,375, and mean per diem charge = $610). One-way ANOVAs were performed on each of these resource intensity measures which showed significant differences ($p < .001$) by purpose of admission group. Planned comparisons revealed significant differences among all groups at the .05 level.

Tables 18 and 19 present the relationship between the purpose of admission groups and the DRGs. As shown in Table 4, almost three quarters of the palliation discharges fell into digestive malignancies DRGs (DRG 172/173) with 20 percent of the remaining discharges in other medical DRGs in other MDCs and 7 percent in other medical DRGs in MDC 6. Mean total charges were similar among the three DRG groupings. As would be expected, about 90 percent of the major surgery discharges, both with and without diagnostic work-up were accounted for by the rectal resection DRGs (DRG 146/147) and the small and large bowel procedure DRGs (DRG 148/149). Most of the remaining surgical discharges were classified in other surgical DRGs in MDC 6 and had significantly lower total charges than the surgical discharges in DRG 146/147 and DRG 148/149. Over 70 percent of the active treatment without diagnostic work-up discharges were grouped into the digestive malignancies DRG, with another 12 percent grouped in the DRG 410, Chemotherapy. Mean total charges for the digestive malignancies discharges were almost twice as high as the chemotherapy discharges in the active treatment without diagnostic work-up group. Over three fourths of the diagnostic work-up only group were placed into DRG 172/173. Only 5 percent of the diagnostic work-up discharges were classified in other MDC6 surgical DRGs; however, these discharges were more than twice as expensive as the digestive malignancies DRG discharges. These results suggest that, except for the palliation group, the DRGs appear to be splitting the purpose groups by resource costs.

Results in Table 19, however, indicate that the purpose groups are also disaggregating DRGs by resource cost. Particularly for DRGs 410 and 172/173, different purpose groups have clearly different mean charges. The 5.4 percent of cases in DRG 410 which fell into the active treatment with diagnostic work-up had mean charges almost 50 percent higher than the cases which were grouped into active treatment without diagnostic work-up. Chemotherapy patients who receive diagnostic tests and procedures cost more per discharge than those who do not. The total costs of these two groups of patients may be similar, however, if outpatient diagnostic costs were included. Similarly, discharges in DRG 172/173 which fell into the palliation and diagnostic work-up only groups had mean charges nearly 50 percent lower than those in DRG 172/173 in the active treatment with and without diagnostic work-up groups. The multivariate results to be discussed later address the improvement in variance explained in total charges attributable to the purpose groups after controlling for DRG.

Tables 20-22 present results of the purpose groups by patient-related variables. Table 20 displays the comparison for three age groups: patients age 65-74; age 75-84 and 85 and over. The purpose group with the highest proportion of discharges for patients age 85 and over was the diagnostic work-up only group (19.3%). The lowest proportion of discharges for very elderly patients were found in the active treatment without diagnostic work-up (7.5 %) and the active treatment without diagnostic work-up--primarily chemotherapy--group (1.6%). This latter group had the highest proportion of discharges for patients age 65-74 (59.3%). Though the average charges for discharges in the three age groups were similar across all purpose groups, average charges did vary within three of the purpose groups by age. Discharges for younger patients had lower average charges in the major surgery without diagnostic work-up and the active treatment without diagnostic work-up groups.

Table 21 displays the purpose groups analyzed by type of secondary diagnosis (i.e., complication, comorbidity, distant metastasis or any combination of the three). The highest proportion of discharges for patients with none of the three types of secondary diagnoses were found in the major surgery without diagnostic work-up group (14.8 %) and the active treatment with diagnostic work-up group (10.8 %). Discharges falling into the major surgery groups were more likely to have a comorbid condition flagged and less likely to have a complication flagged. Active treatment without diagnostic work-up discharges were most likely to have a complication flagged. As expected, the palliation group had the highest proportion of discharges with more than one type of secondary diagnosis flagged (60.8 %). No clear relationship between average charges and secondary diagnosis type was found.

Table 22 shows the relationship between purpose group and discharge status as alive or dead. Overall, 8.9 % of cases fell into the discharged dead category. This proportion varied markedly by purpose group from over a third of discharges in the palliation group to 4 and 5 % in both major surgery groups. Overall, average charges were about 1.5% lower for discharges in the discharged dead category. Looking at each admission group separately, however, discharges in the discharge dead category were always higher cost. This finding is explained by the high proportion of deaths in the low cost palliation group. The difference in mean charges between patients discharged alive and dead was pronounced in certain purpose groups. Both active treatment group discharges had mean charges for those patients discharged dead that were more than twice that of those discharged alive. In addition, both major surgery groups showed approximately 40% higher mean charges for discharges for patients that expired. In contrast, palliation cases in the discharged dead category had average charges 8% higher.

The final group of tables, Tables 23-25, display results separated by for purpose group and hospital and regional variables. In Table 23, purpose group is analyzed by hospital bed-size. Clear differences by purpose group emerge. More than half (62%) of the palliation discharges were discharged from hospitals under 300 beds -- 22% of these cases were discharged from hospitals with less than 100 beds. In contrast, discharges in the major surgery and active treatment groups were somewhat more likely to have been discharged from hospitals with more than 300 beds. One-third of the active treatment cases with diagnostic work-up were discharged from hospitals with over 500 beds. Discharges from the active treatment without diagnostic work-up had the lowest percent of discharges from hospitals with less than 100 beds (8.4%). Average charges were found to be related to bed-size. Overall, discharges from the largest bed-size category hospitals had average charges 32% higher than those from the smallest hospitals. This relationship also varied by purpose group. Discharges from 500+ bed hospitals were 88 % more expensive than those from under 100 bed hospitals for diagnostic work-up only cases and 52 % more expensive for palliation cases. Discharges from both major surgery groups from 500+ bed hospitals were both approximately 10% more expensive than their counterparts from hospitals under 100 beds.

Table 24 displays discharges by purpose group and hospital control (i.e., not for profit, proprietary or public). Overall, 14.0% of discharges were from public hospitals. For palliation and active treatment without diagnostic work-up discharges, however, this proportion rose to 16.7% and for diagnostic work-up only discharges the proportion rose to 16.9%. Major surgery discharges were less likely to be from public hospitals and more likely to be from not-for-profit institutions. Proprietary hospitals had a slightly higher proportion of discharges in the diagnostic work-up only group. Proprietary hospitals had the highest average charges--33% higher than public hospitals' average charges. This finding persisted across all of the purpose groups except for diagnostic work-up only, in which not-for-profit hospitals had slightly higher average charges than did the proprietary institutions (2%).

In Table 25, discharges are shown by MSA type (urban and rural) and purpose group. Overall, 79.2% of discharges were from hospitals located in urban areas. This proportion varied somewhat by purpose group. Palliation and diagnostic work-up only discharges from rural hospitals were relatively more common (28 and 27 %, respectively) while and active treatment discharges were relatively less likely to be from rural hospitals (approximately 14% of discharges). Urban discharges had average charges that were 30 percent higher than rural discharges. The urban-rural difference was the most pronounced for palliation discharges (57% higher in urban areas) and diagnostic work-up only discharges (70% higher in urban areas).

Results for Breast Cancer

Breast cancer discharges fall primarily into two purpose of admission groups: major surgery without diagnostic work-up (42.2%) and major surgery with diagnostic work-up (35.1%). As with lung and colon cancer, this result is consistent with the most commonly used clinical treatment approaches for breast cancer as discussed in an earlier section of this report.

Tables 26-28 present results by purpose of admission groups for three measures of resource intensity (total charges, per diem charge and length of stay). Mean total charges for all discharges was $3,841; mean per diem charge was $640; and mean LOS was 6.8. The purpose group with the highest mean charges was the active treatment with diagnostic work-up group (mean = $4,476). The stability of this mean is suspect, however, since this group contained less than 2 percent of total discharges. Major surgery with diagnostic work-up had the second highest mean charges (mean = \$4,394). Lowest mean charges was found in the active treatment without diagnostic work-up group (mean = \$3,030). Less variation among the treatment group mean charges is found for breast cancer compared to lung and colon cancer discharges. Per diem average charges were also highest in the active treatment without diagnostic work-up group (mean = \$731) while average LOS was shortest (mean = 4.4), indicating that the admissions in this group were for care that was short but intense in nature. The palliation group had the lowest average per diem charges (mean = \$422) but the longest LOS (mean = 9.3). Per diem charges for surgical discharges averaged \$656 and mean LOS was 7.0. One-way ANOVAs were performed on each of these resource intensity measures which showed significant differences ($p < .001$) by purpose of admission group. Planned comparisons revealed significant differences among all groups at the .05 level.

Tables 29 and 30 present the relationship between the purpose groups and the DRGs. As shown in Table 4, almost 70 percent of the palliation discharges fell into DRG274/275 (malignant breast disease) with the remaining 30 percent in medical DRGs other than those in MDC9. Mean total charges were similar among the two DRG groupings. Over 80% of the discharges in both the surgery groups fell into DRG257/258 (total mastectomy) with the remaining discharges almost entirely in DRG259/260 (subtotal mastectomy). Mean charges in the total mastectomy DRGs for both purpose groups were substantially higher than those in the subtotal mastectomy groups. Thirty percent of the active treatment with diagnostic work-up discharges fell into the breast malignancy

DRGs. However, over 50% of these discharges were in non-breast cancer DRGs, indicating that the breast cancer was coded as a secondary diagnosis. About 60% of the active treatment without diagnostic work-up fell into DRG410, chemotherapy. Across all purpose groups, discharges in this DRG are strikingly less expensive than those in the other breast cancer DRGs (mean = $1,502 compared to $3,329 for all cases). Diagnostic work-up only fell primarily into the breast malignancy DRGs with about a quarter in the subtotal mastectomy group (presumably for breast biopsies or "lumpectomies") and one-fifth in the medical DRGs other than those in MDC9. These results suggest that for breast cancer, the DRGs appear to be splitting the purpose groups by resource costs.

Results in Table 30, however, indicate that the purpose groups are also disaggregating DRGs by resource cost. Particularly for DRGs 410 and 259/260 and 274/275, different purpose groups have clearly different mean charges. The almost 6 percent of cases in DRG410 which fell into the active treatment with diagnostic work-up had mean charges over 80 percent higher than the cases which were grouped into active treatment without diagnostic work-up. Similar to the lung and colon results, chemotherapy patients who received diagnostic tests and procedures cost more per discharge than those who did not. The total costs of these two groups of patients may be similar, however, if outpatient diagnostic costs were included. Discharges in DRG259/260 (subtotal mastectomy) which fell into the major surgery with diagnostic work-up group had mean charges 30% higher than those in the major surgery without diagnostic work-up group.. Discharges in DRG274/275 (breast malignancy) which were grouped in the active treatment classes had mean charges 30% higher than those in the palliation group.

Tables 31-33 examine the purpose groups by patient-related variables. Table 31 displays results for three age groups: age 65-74; age 75-84 and 85 and over. The purpose group with the highest proportion of discharges for patients age 85 and over was the palliation group (12.1%). The lowest proportions of discharges for very elderly patients were found in the active treatment groups (7.6% in major surgery with diagnostic work-up and 3.5% in active treatment without diagnostic work-up). This latter group had the highest proportion of discharges for patients age 65-74 (78.1%). Though the average charges for discharges in the three age groups were similar across all purpose groups, average charges did vary within three of the purpose groups by age. Discharges for patients age 85 and over had higher charges in the palliation group and in the active treatment with diagnostic work-up group.

Table 32 displays the purpose groups analyzed by type of secondary diagnosis (i.e., complication, comorbidity, distant metastases or any combination of the three). The highest proportion of discharges for patients with none of the three types of secondary diagnoses were found in the two surgery groups (27.7% for major surgery with diagnostic work-up and 35.8% for major surgery without diagnostic work-up). These two surgery groups contained the lowest proportions of discharges with secondary diagnoses flagged by all three secondary diagnosis types. Discharges falling into the major surgery groups were more likely to have a comorbid condition flagged and less likely to have a complication flagged. Active treatment without diagnostic work-up discharges were most likely to have a complication flagged. Contrary to expectations, the palliation group did not have the highest proportion of discharges with more than one type of secondary diagnosis flagged, although this finding could be the result of underreporting of secondary diagnoses in patients with life-threatening illnesses (Jencks et al., 1988). While 56.4% of discharges in this group did have more than one type flagged, 58.6% of the discharges in the active treatment without diagnostic work-up group had more than one flagged. Overall, cases with more than one type of secondary diagnosis flagged were more expensive, but this relationship varied among the purpose groups.

Table 33 shows the relationship between purpose group and discharge status as alive or dead. Only 3.0% of cases fell into the discharged dead category. As with the other cancers studied, this proportion varied markedly by purpose group. Over a quarter of discharges in the palliation group were discharged dead while less than 0.2% died in-hospital in both major surgery groups. Across purpose groups, average charges did not vary by discharge status. However, difference did occur in certain purpose groups. Cases with active treatment with diagnostic work-up who died had average charges 77% higher than those who lived; cases with active treatment without diagnostic work-up who died had average charges over twice as high as those who lived. In contrast, palliation cases in the discharged dead category had average charges 9% lower than did those who died.

The final group of tables, Tables 34-36, display results for purpose group by hospital and regional variables. In Table 34, purpose group is analyzed by hospital bed-size. Clear differences by purpose group emerge. Almost 60% of the palliation discharges were discharged from hospitals under 300 beds--almost 25% of these cases were discharged from hospitals with less than 100 beds. In contrast, discharges in the other groups were most likely to have been discharged from hospitals with between 100 and 500 beds. Unlike lung cancer, no group had the preponderance of cases discharged from the very large hospitals. Average charges were found to be related to bed-size--overall, discharges from the largest hospitals had average charges 28% higher than those from the smallest hospitals. This relationship remained fairly constant in each purpose group.

Table 35 displays discharges by purpose group and hospital control (i.e., not for profit, proprietary or public). Overall, 13.5% of discharges were from public hospitals; 8.8% were from proprietary hospitals and 77.7% were from not for profit hospitals. Unlike lung cancer, these proportions did not vary across purpose groups. As in the other cancers studied, proprietary hospitals had the highest average charges--27% higher than public hospitals' average charges. This finding held across all of the purpose groups, except for diagnostic work-up only, in which not for profit hospitals had slightly higher average charges than public hospitals.

In Table 36, discharges are disaggregated by MSA type (urban and rural) and purpose group. Overall, 80.2% of discharges were from hospitals located in urban areas. This proportion varied by purpose group. Palliation discharges from rural hospitals were relatively more common (28%) while major surgery and active treatment discharges were relatively less likely to be from rural hospitals (both approximately 18% of discharges in these purpose groups). Urban discharges had average charges that were 23% higher than rural discharges. The urban-rural difference was the most pronounced for palliation discharges (42% higher in urban areas) and diagnostic work-up only discharges (48% higher in urban areas).

Summary of Results from Descriptive Analyses

- The distribution of discharges in the purpose of admission groups was similar for both breast and colon cancer. For these cancers, the two most common admission purposes were major surgery with and major surgery without diagnostic work-up, accounting for over two thirds of all cases. The least common admission purpose for breast and colon cancer was for active treatment with diagnostic work-up (representing less than 2 % of cases for each cancer). The distribution of cases for lung cancer, however, was quite different. Diagnostic work-up only was the most common admission purpose, accounting for well over one third of the cases. Palliation was the next most common purpose, accounting for nearly a quarter of the cases, and active treatment without diagnostic work-up accounted for another 20% of cases. These results are consistent with clinical treatment approaches employed for these cancers.

- Mean total charges were highest for colon cancer ($7,730) and lowest for breast cancer ($3,841). Mean total charges for lung cancer were $4,882. Mean total charges varied very little among the purpose groups for breast cancer compared to the other cancers (a range of $2125 compared to $6,422 for colon and $7,094 for lung). For lung and colon cancer, the highest mean charges were for the major surgery with diagnostic work-up group ($10,174 for lung and $9,797 for colon). The lowest mean total charges for all three cancers were in the active treatment without diagnostic work-up group ($3,080 for lung, $3,375 for colon, and $2,351 for breast). This group is comprised primarily of admissions for chemotherapy. Unlike the other cancers, the highest mean total charges for breast cancer were in the active treatment with diagnostic work-up group ($4,476).

- Overall, there was less variation among the three cancers in average per diem charge than there was for mean total charges. Lung cancer had the highest per diem charge ($678), while colon and breast cancer had per diem charges of $645 and $640, respectively. The palliation group consistently had the lowest per diem charge across all three cancers ($431 for lung, $422 for breast, and $404 for colon). The groups with the highest per diem charge were major surgery with diagnostic work-up for lung cancer ($769), active treatment with diagnostic work-up for breast cancer ($731), and major surgery without diagnostic work-up for colon cancer ($707).

- Colon cancer had the longest average LOS (12 days). The average overall LOS for lung and breast cancer was 8 and 7 days, respectively. Looking at LOS by admission group, there was a direct relationship between mean total charges and LOS for colon and lung cancer. Active treatment without diagnostic work-up had the shortest LOS (7 days for colon and 5 days for lung) and major surgery with diagnostic work-up had the longest LOS (15 days for colon and 13 days for lung). For breast cancer, LOS did not correspond as closely to mean charges. While the shortest LOS and lowest mean total charges for breast cancer were both found in the active treatment without diagnostic work-up group, the longest LOS for breast cancer was in the palliation group (9 days), while the highest mean total charges were in the active treatment with diagnostic work-up group.

- Cross-tabulating the purpose of admission groups with the major DRGs for each cancer showed that breast and colon cancer had the highest proportion of admissions in surgical DRGs (82.2% for breast and 69.5% for colon) while lung cancer had the lowest proportion of admissions in surgical DRGs (24.9%). This finding is consistent with the clinical approach towards these conditions. Lung cancer, however, had the largest proportion of admissions in the chemotherapy DRG, DRG410, (13.8%), while breast and colon cancer had only 2.9% and 4.1% DRG410 admissions, respectively. The cross-tabulation also showed that the purpose of admission groups were able to disaggregate charges within DRGs: Admissions for chemotherapy (DRG410), that fell into the active treatment with diagnostic work-up group had consistently higher mean charges than chemotherapy admissions that fell into the active treatment without diagnostic work-up group. In addition, admissions that were grouped in the medical malignancy DRGs at discharge had consistently higher charges if the purpose of admission was for active treatment, not palliation.

- When patient age was considered for all three cancers, the largest proportion of admissions for individuals over 85 were for colon cancer (13.6%). For breast cancer, 9.4% of the admissions were for individuals in this age bracket and for lung cancer only 3.8% of admissions were for those over 85.

- Lung cancer had the most admissions with metastatic disease, comorbidities and complications (58%) compared to 48.5% for colon cancer and 28.5% for breast cancer, suggesting that lung cancer admissions were clinically more complex than those with the other cancers.

- Lung cancer cases had higher in-hospital mortality rates (17.8%), compared to 3.0% for breast cancer and 8.9% for colon cancer. As expected, the purpose of admission group with the highest death rate was palliation, across all three cancers, (35.5% for lung, 35.9% for colon, and 26.7% for breast).

- For all three cancers, some difference in the distribution of admissions by hospital size by purpose of group was found. Most admissions were in medium to large-size hospitals with over 100 beds. Lung cancer had slightly fewer admissions in small, less than 100 bed, hospitals -- 9.1% compared to 13.4% for colon and 12.2% for breast. A higher percentage of admissions for palliation were to smaller hospitals with less than

300 beds than to hospitals with 300+ beds. In addition, a slightly higher percentage of surgery admissions were to hospitals with over 300 beds than to hospitals with less than 300 beds.

- The distribution of admissions by type of hospital control also varied somewhat among the three cancers. The majority of admission were in non-profit hospitals; this held true across all purpose of admissions groups. The public hospitals were most heavily utilized for the palliative and diagnostic evaluation only groups; suggesting that casemix was more severe or that less care was delivered.[4]

- Looking at the distribution of admissions by major statistical area (MSA), across all cancer types and purpose of admission groups, the majority of admissions were to hospitals in urban areas (82.7% for lung, 79.2% for colon, and 80.2% for breast). The palliation group had the most admissions in rural hospitals (28.0% for lung, 27.5% for colon, and 27.7% for breast). This finding suggests that patients are admitted and/or transferred to more geographically convenient community hospitals for palliative care.

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[4] A cross-tabulation of our complexity measure (presence/type of secondary diagnoses) and hospital control showed no variation, but this finding does not rule out true severity differences.

Multivariate Analyses of Resource Use

In this component of the analysis, we developed and tested several models of resource use for the three cancers which allowed us to measure the explanatory power of purpose of admission. Three principles guided the development of the models: First, we used only variables related to patient casemix which would be measurable at discharge using data available on the discharge abstract. Second, we only included variables which could reasonably be used in a reimbursement system (e.g., discharged alive or dead was not included). Third, we used statistical techniques which allowed us to estimate the added impact of purpose of admission after grouping by DRG.

The model with the best explanatory power overall took the following form:

$$Yi = ai + BpXpi + BsXsi + BdXdi + BpgXpgi + ei$$

where Y = total charges (FY 1985 dollars)

ai = intercept term

Xp = patient demographic variables

Xs = severity variables

Xd = Adjacent DRG (ADRG) variables[5]

Xpg = purpose group variables

e = error

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[5] ADRG were used because other variables (age and the severity variables) split the groups into DRGs.

This model was tested using ordinary least squares regression with stepwise entry of blocks of variables. The first block contained the ADRG variables; the second the demographic and severity variables and the third block was composed of the purpose group variables. The analyses were restricted to discharges falling into one of the cancer-related DRGs for each cancer. Variable definitions for the model as applied to lung, colon and breast cancer are presented in Tables 37 to 39.

In the discussion of the results below, we also briefly present findings from two alternative models. One only includes the cancer-related DRGs and the purpose groups. The second, alternative model adds interaction terms to the full model which consist of the product of the ADRGs and the purpose groups. This latter model tests for the possibility that in some ADRGs, the purpose groups identify cases with significantly different total costs.

Results for Lung Cancer

Results of the full model for the 30,907 lung cancer cases are displayed in Table 40. The full model explained over 31 percent of the variance in total charges; all variables except one severity dummy variable (presence of metastatic disease, comorbidities and complications) were significant at least at the .05 level. The results for the individual variables mirrored the findings of the descriptive analyses discussed earlier and thus will not be repeated here.

The ADRG group variables, the first block "stepped in" to the equation, had an R squared of 0.26052, indicating that the ADRGs alone accounted for over a quarter of the variation in total charges. The second block, patient age and severity, increased the R squared by 2 percent, to 0.2822. The purpose groups, added in step 3, improved the R squared by another 3 percent, to 0.3138. All changes in the R squared values were statistically significant at the .001 level.

The reduced form of the model provided a direct estimate of the contribution to R-squared made by the purpose groups over the DRGs. The first block stepped was four dummy variables which represented four individual lung cancer DRGs: DRG076; DRG077; DRG075 and DRG410. The omitted reference group was DRG082. The second block consisted of the purpose group variables as used in the full model. This reduced model explained slightly less of the variation in total charges--R squared equalled 0.2979--than the full model. The DRGs alone accounted for over 26 of the variance and the purpose groups improved the explanatory power of the DRGs by 3.4 percent.

Although the 3-4 percent improvement caused by the purpose of admission groups may not appear dramatic, these results indicate that purpose of admission is associated with large differences in expected charges for discharges in certain DRGs. For example, using the coefficient and constant values in the full model, a 66 year old patient discharged in DRG082 with secondary diagnoses indicating the presence of comorbidities and complications who was admitted for active treatment with diagnostic evaluation has expected total charges of $7,155. This same patient admitted for palliative care has expected total charges of $4,386, a 63 percent difference.

Despite these calculations which suggest that the purpose groups do split some DRGs, the results of the regression model which included the interaction terms proved disappointing. The interaction terms added only 0.3 percent to the explanatory power of the model.

Results for Colon Cancer

Table 41 presents the full model results for the 22,742 colon cancer cases. The model explains almost 35 percent of the variance in total charges for these discharges. All the individual variables except one--the palliation dummy variable--are statistically significant at the .001 level. The effects of the individual variables in the model are consistent with those reported earlier and thus will not be discussed here.

The ADRG variables entered in step 1 produced an R squared of 0.3021; the age and severity variables increased the R squared by 3.9 percent to 0.3421. The purpose group variables had only a marginal impact--they caused less than a one percent improvement in the overall R squared.

The reduced form of the equation which used two steps (first, individual colon cancer-related DRGs, and second the purpose groups) produced very similar results. The DRGs alone accounted for 31 percent of the variance and the purpose groups added less than one percent to the explanatory power of the DRGs. Similar to lung cancer, the interaction terms did not add appreciably to the strength of the full model.

Results for Breast Cancer

The results of the full model for the 12,312 breast cancer discharges are presented in Table 42. The breast cancer results differ from both the lung and colon cancer results. Unlike the lung and colon models which explained one-third of the overall variation in total charges, the full breast cancer model only explains 15 percent of the variance in total charges. Two individual variables are not significant--the dummy representing patient age 75-84 and the dummy representing palliation. The effects of individual variables on total charges were discussed earlier.

The ADRG group block entered in step 1 accounted for only 8.5 percent of the variance in total charges. The severity variables entered in block 2 raised the R squared by almost 4.5 percent, to 0.1301. For all the cancers, this was the largest increase in explanatory power caused by the severity variables. The purpose groups increased the R squared by another 2 percent.

The reduced model which stepped in six individual breast cancer-related DRGs in step 1 and the purpose groups in step 2 produced an R squared of only 0.1125. The DRGs alone accounted for slightly over 8 percent of the variation in total charges and the purpose groups improved the model by 2.6 percent.

The impact of the purpose groups can be illustrated by contrasting the expected charges of two cases in the same DRG admitted for different purposes using the values from the full model. A 68 year old woman discharged into DRG 274 (malignant breast disease) with secondary diagnoses indicating metastatic disease who was admitted for active treatment with diagnostic evaluation has expected charges of $4,565. This same patient admitted for diagnostic evaluation only has expected charges of $2,702, a 69 percent difference. Similar to lung cancer, however, adding interaction terms to the full model only improved the proportion of variance explained by 0.6 percent.

Summary of Results from Multivariate Analyses

The major findings from the regression results are as follows:

o The lung and colon cancer models explained over 30 percent of the variation in FY1985 total charges while the breast cancer model was only able to explain 15 percent of the variance.

o The DRGs alone accounted for 26 percent of the variation for lung cancer and 31 percent of the variation for colon cancer, but only 8 percent of the variation for breast cancer.

o The age and severity variables made the greatest impact on the model's ability to explain cost difference for breast cancer (4.5%) and colon cancer (3.9%). These variables improved the model only 2% for lung cancer.

o The purpose of admission groups caused the most improvement over the DRGs alone in the lung cancer model in which they increased the model's explanatory power by 3.4 percent. The groups had the least impact for colon cancer, which was the strongest model of the three cancers. The groups improved the model by 2.6 percent for breast cancer.

o Despite their modest contribution to R-squared, the purpose of admission groups do identify cases with widely different costs within DRGs. For lung and breast cancer, two similar patients, grouped in the same DRG at discharge, could have markedly different predicted total charges depending upon their purpose of admission.

These results clearly show that the DRGs vary by cancer in their ability to account for resource variation. For selected DRGs, chemotherapy and medical malignancy DRGs, purpose of admission is able to "split" DRGs with high intra-DRG variation.

PURPOSE OF ADMISSION USING CHART REVIEW DATA

We performed a small study using medical chart review data to test the major question: Can purpose of admission explain differences in hospitalization costs for cancer patients? In the secondary data analysis described above, we were able only to assign patients to purpose groups based on the limited discharge abstract data. This method represents a post hoc assignment, which does not reflect the information available at the time of the patient's admission. In this chart review analysis, however, we attempted to assign patients to purpose group based on the information available on admission, thus modeling what would occur in a true prospective system of reimbursement based on admission purpose.

In addition, we aimed to identify other predictive key variables that could not be studied using secondary data. For example, we considered initial admission for the cancer versus a subsequent admission; Do Not Resuscitate (DNR) status of the patient; and if purpose of admission changed during the admission.

Methods

Site Selection--

We selected a sample of five hospitals within the greater metropolitan Boston area to participate in this study; two large urban major teaching hospitals; one mid-size community teaching hospital; and two mid-size community non-teaching hospitals. Discharge data from the 1986 Massachusetts Rate Setting Commission revealed that these five hospitals together treat a significant portion of cases with lung, colon and breast cancers in the greater Boston metropolitan area (48 percent of total discharges in 1986). The choice of hospitals reflected our desire to draw sites from along a teaching and bed-size continuum as well as sites located in urban and non-urban areas. However, these hospitals are not representative of all hospitals either in the state or nationwide, thus the results may not be generalized to other settings.

Selection of the Sample--

Formal approval for the study was obtained from the Human Subjects Review Committee at each hospital. In each of the five study hospitals, a roster of patients who had a principal or secondary diagnosis of one of the three target cancers (lung, breast and colon) between October 1986 and March 1988 was obtained. To qualify for the study, a patient had to be 65 years of age at the time of admission and the admission itself had to be directly related to treatment for the particular cancer. For example, if a patient with a secondary diagnosis of lung cancer was admitted for elective gallbladder surgery, data from that admission would not have been included in the study. From each roster we selected a random sample of 40 patients of each cancer for each hospital, for a total of 799 patients. For this preliminary study, a maximum of up to three admissions was abstracted for each patient.

Data Collection Instrument--

Staff reviewed two chart review instruments, one developed by the University of Miami and the other by the Health Data Institute as background for creation of the data collection instrument that was used for medical record review. A separate data collection instrument was designed for each cancer, but many elements were common across all three cancers. Data collected for each admission included patient demographics, treatment history (including stage of the tumor), admission characteristics (e.g., urgency of admission, referral source, and chief complaint); treatment and procedures performed during the admission; and status at discharge. Appendix E contains the three data collection instruments. Information was also obtained concerning whether this was the initial admission for this cancer, or whether it was a subsequent admission. In addition, data on the purpose of admission was collected. Purpose of admission categories were different than those used in the previously described MEDPAR analysis due to the availability of richer, more detailed clinical record information. The purpose categories were as follows: admission for diagnostic work-up, admission for further evaluation of a biopsy-proven cancer, admission for treatment for the primary tumor site, admission for treatment for secondary (or metastatic) tumor site, admission for treatment for complications of therapy, or admission for palliation, failure to thrive, respite care for family members, problems related to placement, or the need for social services. Finally, the reviewers were asked to determine whether the stated purpose of admission changed between admission and the time of discharge.

Data Collection Process--

Six nurse abstractors were hired to conduct chart audits. These nurses were all R.N.'s with other advanced degrees; five nurses were Ph.D. candidates. These nurses underwent an intensive training session conducted by the Brandeis staff. The instrument was pre-tested on 30 cases from one hospital and extensively revised. Nurse reviewers were instructed in the procedures for obtaining medical charts in each of the hospitals. Each nurse was given a training packet which included directions for coding each variable, a code book for all three instruments, and a patient log sheet in which to note the review status of each patient record. Brandeis staff had weekly contact with each nurse to ascertain progress and answer questions.

Data collection began in July 1988 and was completed in January 1989. Nurses completed weekly activity log sheets which indicated which patient records were requested, the admissions that were abstracted (if appropriate), the time required to abstract each record, and any problems identified. Completed instruments and log sheets were collected by Brandeis staff on a regular basis.

Two steps were taken to ensure patient confidentiality: 1) unique identifiers were assigned to each case without referring to the patient and hospital identifiers; and 2) confidentiality agreements were signed with all participating hospitals.

Once completed, the instruments were checked by two research assistants who were also nurses. Any problems or inconsistencies on the completed forms were flagged and placed in the problem box. Brandeis staff then attempted to solve the "problem" cases. Complicated clinical questions were referred to the clinical consultants. One major problem concerned the quality of data available for staging of the tumor. In about 25 percent of the cases overall (34% for lung, 25% for breast, and 15% for colon) the exact stage of the tumor could not be obtained from the medical record. Description of the tumor, size and location were most often present, but a statement about the exact classification of the tumor was missing, i.e., the Duke's Classification system. These cases were all referred to oncologist consultants. In many cases, they were able to assign a stage to the tumor with the information that was available to them. In other instances, the staging could not be determined. The completeness of the medical record varied across hospitals and even among records within hospitals. While every attempt was made to obtain the necessary information, in some cases this was not possible.

Cost data for each hospital was obtained from the Massachusetts Hospital Association (MHA) discharge data set. Each hospital gave permission for the data to be released. A roster of patient identification numbers, admission dates, and discharge dates was provided to the Massachusetts Hospital Association. These discharge data provide information on admission charges (total charges as well as charges by cost center), length of stay, DRG, admission to ICU, discharge destination, etc., and they were then merged with the chart review data in order to create a complete data set.

In order to make charge data comparable across hospitals, we adjusted the charges using cost-to-charge ratios that we developed using HCFA cost reports for each hospital for the year's corresponding to the MHA data. The following method was used. First, cost-center-specific charges from the HCFA cost report were divided into cost-center-specific charges (also from the HCFA cost report) to produce cost-to-charge ratios for each cost center for each hospital. Second, hospital room and board charges were converted to per diem costs by dividing the total costs for each room and board category as indicated in the HCFA cost report by the total number of bed days in each category (also obtained from the HCFA cost report). Finally, to produce the adjusted charges, the cost-to-charge ratios for each cost center were multiplied by the charges reported in the MHA data for each cost center. Room and board charges were adjusted by multiplying the per diem cost, calculated by the above technique, by the actual number of bed days in each hospital-specific room and board category. Charge data were not adjusted by area wage differences since all hospital were located in a single area.

Inter-rater Reliability Results--

A random sample of 76 patient records was selected to determine inter-rater reliability. The sample was composed of five records in each cancer type across all five participating hospitals. In cases where the patient experienced multiple hospitalizations during the study time frame, only one admission was randomly selected for the reliability analysis. For reliability reviews, a different nurse conducted the second record abstraction. Selected key variables were abstracted for assessing inter-rater reliability. Appendix F presents details of the inter-rater reliability results. For numeric variables (e.g., place of birth, admission date, discharge date, etc.), inter-rater reliability was assessed by calculating person coefficients. For nominal variables (e.g., diagnoses, referral source, purpose of admission, etc.), inter-rater reliability was assessed by calculating the percent agreement between the two record reviews. The overall reliability was .90.

Analysis Plan--

Data were analyzed to determine the impact of several key variables on total adjusted charges. These variables included: the purpose of admission, whether the hospitalization was an initial admission for the cancer versus a follow-up admission, DNR status of the patient, and if purpose of admission changed during the course of the hospitalization. Additionally, we sorted patients into two groups, those for whom this was the initial admission and those for whom it was not, and then examined the relationship between purpose group, death and DNR status.

Results

Results are reported for each type of cancer (lung, colon and breast) separately and aggregated across all five institutions because small samples at each hospital make comparisons across sites statistically unreliable. Since these cancers differ considerably in terms of disease course and clinical progression, morbidity and mortality, we felt that analysis should consider each cancer independently.

Lung Cancer Results--

Table 43 indicates that the highest percentage of cases were admitted for palliation (32%), followed closely by those patients who were admitted for diagnostic work-up only (30%). The percentage of cases in the other five admission group types are very small, cumulatively accounting for only a little more than one-third of the cases. As might be expected, patients having major surgery with a diagnostic work-up were the most expensive cases with a mean total adjusted charges of over $16,000, nearly twice as expensive as patients having active treatment with diagnostic work-up or patients having only a diagnostic work-up.

The admission under study was a follow-up hospitalization for slightly more than half (52%) of the cases with lung cancer (Table 44). However, initial admissions were nearly twice as expensive as subsequent admissions, $11,300 and $6400, respectively.

Table 45 indicates that, except for one group, mean total adjusted charges for initial admissions for lung cancer patients were considerably higher across all admission groups than for patients for whom this was a subsequent admission. The one exception to this were patients receiving active treatment but no diagnostic work-up.

Table 46 reveals that approximately two-thirds of patients with a DNR (Do Not Resuscitate) status were equally distributed between the palliation and diagnostic evaluation only groups. On average, those patients with DNR status were slightly more expensive than those patients who did not have a DNR order in their chart. However, when the cases are examined more closely by admission groups, large differences in adjusted charges emerge among patients having major surgery with diagnostic work-up (four-fold difference) and patients admitted for diagnostic work-up only (two-fold difference). Patients having major surgery without diagnostic work-up were less expensive if a DNR order was present than if it were not.

When we examined the relationship between patient death, purpose group, and charges (Table 47), we found that, on average, cases who died were more expensive than patients who did not die during the hospitalization. Among patients having major surgery with diagnostic evaluation these differences were particularly striking. Patients in the group who died were 3 1/2 times as expensive as patients who did not die, and this same finding was also apparent among patients hospitalized for diagnostic work-up only. It is interesting to note that over half of the patients admitted for palliation died, a finding that supports the face validity of the purpose catagorizations.

The purpose of admission changed for nearly 20% of the patients admitted with lung cancer and mean total adjusted charges for this group were nearly twice as high ($15,000 compared to $7,600) as for those cases whose purpose of admission did not change (Table 48).

Colon Cancer Results--

More than half of the patients with colon cancer were admitted for surgery, with or without an accompanying diagnostic evaluation (Table 49) and the mean total adjusted charges across all admission groups were almost $14,000. Cases having surgery with no diagnostic evaluation cost nearly the same as those having a diagnostic evaluation only. Patients hospitalized for active treatment only had the lowest charges.

The index admission was the initial hospitalization for nearly 60% of colon cancer patients in this study, and as was true with lung cancer patients, these initial hospitalizations were more costly than were subsequent admissions (Table 50). Closer examination of initial versus subsequent admission by admission groups revealed that large differences were evident across these two groups (Table 51). For example, major surgery with evaluation was more expensive among patients with a subsequent admission; in contrast, palliation and diagnostic evaluation were both more expensive among patients with an initial admission. In general, palliation admission were quite expensive.

As expected, we found proportionately more DNR orders (54%) among patients hospitalized for palliation (Table 52). On average, as was true with lung cancer patients, DNR patients are slightly more expensive than the other patients, but considerable differences in the other admission group and diagnostic evaluation only group accounted for the majority of this difference.

When we explored the relationship between death, admission group and charges among cases with colon cancer, we found that, as was true with lung cancer cases, patients who died were more expensive than cases who did not die (Table 53) and this finding was consistent across all purpose groups. Patients comprising the "other" admission purpose group were also quite expensive overall compared with the other admission group categories.

Twenty-three percent of cases with colon cancer had their purpose of admission change during the course of their hospitalization. In these cases adjusted charges were twice as high as adjusted charges for the majority of cases in which the purpose of admission did not change during the hospitalization (Table 54).

Breast Cancer Results--

Among cases with breast cancer, nearly 60% had surgery, with or without a diagnostic evaluation, while the next highest group were patients who were hospitalized for diagnostic work-up only (Table 55). However, among breast cancer patients, those having either active medical treatment without a diagnostic evaluation, diagnostic evaluation only, or palliation were more expensive than were cases having surgery, a result not found in the other cancer groups.

The index admission represented the initial hospitalization for the cancer in over 2/3 of breast cancer cases, and in contrast with the other two cancer groups, subsequent admissions were more expensive than were initial admissions (Table 56). In particular, diagnostic evaluation and palliation were 60% more expensive in cases having a subsequent admission versus an initial admission (Table 57). Only surgery with evaluation was more expensive for initial admission cases with breast cancer.

Patients receiving active medical treatment were the most expensive. The same is true among DNR patients with breast cancer having active treatment without diagnostic evaluation (Table 58). This group includes cases having infusions, blood, etc., probably a sicker group of patients with more procedures and treatments being performed. Overall, a DNR patient was more expensive than a patient without a DNR order.

When we explored the relationship of death to admission group and charges among patients with breast cancer, we found that the patients who died were twice as expensive as those who did not, and deaths only occurred in patients in the active treatment without diagnostic evaluation group or the palliation group. Patients who died did not have any surgical procedures and 7 out of the 9 patients who died were hospitalized for palliation (Table 61). Due to the very small number of patients in these catagories, these results are only suggestive.

In this group of cancer patients, the purpose of admission only changed in 8% of the cases, a lower percentage than we found in the other two cancer groups. However, as was consistently true in the other two cancers, when the purpose of admission changed, the cases were more expensive, in this instance, almost twice as expensive (Table 62).

Summary of Results from the Medical Chart Review

It is important to emphasize that since the numbers are small in each diagnostic area, conclusions should be drawn with caution. Since the cancers that were studied are all different with respect to course and outcome, we chose not to combine the data across these diagnoses. The major findings from the medical chart review analysis are as follows:

- A comparison of several measures between the medical chart sample and the national sample used in the MEDPAR analysis indicated that the nmedical chart sample was representative. First, the proportion of admissions falling into each of the purpose categories was very similar. Most lung cancer admissions were categorized into diagnostic evaluation only or palliation. Most colon and breast cancer admissions were categorized into the surgical groups. Second, the admissions with the highest average total charges were in the colon cancer group ($10,447), followed by lung cancer ($6,970) and breast cancer ($4,994). Average LOS was longest for the colon cancer patients, followed by lung and breast cancer. These rankings for total charges and average LOS are the same as those found in the national sample. The chart review sample differed from the national sample on the rankings on average per diem charge, however. Breast cancer admissions from the chart review sample had the highest per diem charge, followed by lung and colon cancer. In contrast, in the national sample, lung cancer admissions had the highest per diem average charge, followed by colon and breast.

- On average, patients who had DNR orders were more expensive than were patients without a DNR order in all three cancer groups. This finding was somewhat unexpected. While implementation of DNR status does not necessarily cause a discontinuation of treatments in progress, it does generally result in fewer heroic, expensive measures being undertaken at the patient's or family's request;

- In nearly all cases, patients who died were more expensive than patients who did not die in all three cancer groups; and

- When the initial purpose of admission changed, cases in all three cancer groups were always more expensive, frequently nearly twice as expensive.

Differences in costs were found among the various admission purpose categories among the three cancers.

- Major surgery with diagnostic evaluation was the most expensive category among cases with lung cancer,(nearly twice the combined average of all categories), while the "other" group was the most expensive category among colon cancer cases. Active treatment was the most expensive admission purpose category among breast cancer cases, nearly twice the average of all the categories combined.

- While the initial admission was more expensive than were subsequent admissions among cases with colon and lung cancer, this was not true for breast cancer cases.

Analysis of average length of stay (LOS) and average per diem charges indicated that LOS and per diem costs were highest for surgical admissions in lung cancer; LOS was highest for active treatment cases for breast cancer and surgical admissions had the highest per diems; and LOS and per diem charges were highest in the other purpose group colon admissions.

Patients who had a DNR order were, on average, more expensive than cases who did not. Theoretically, at least, a DNR order should restrict resource use but that may depend on the point during the admission that the DNR order is written. In some cases, it may have been ordered at the end of an admission when the patient took a turn for the worse having already received many services. In future research, framing the DNR order in relation to date of admission and/or date of surgery will be useful.

The initial admission was less expensive than subsequent admissions for cases with breast cancer, and the reverse was true for the other two cancers. A possible explanation is that in breast cancer there are fewer tests to perform, less complicated surgical procedures, and no use of "scope" procedures. Therefore, charges may be driven to some extent by the anatomy of the problem and the range of expensive treatment and diagnosis options available.

In these analyses, patients who were admitted for palliation were not inexpensive, and this group needs to be further explored to determine if their charges were more related to length of stay or intensity of care.

The medical record review process was successful in characterizing admissions using the purpose of admission typology. However, in some cases, determining whether the purpose of admission changed proved to be a difficult task for the reviewers. We asked them to retrospectively review a record, determine what the purpose of admission was at the time of admission, and then decide if that purpose changed over the course of hospitalization. In the case of surgery, this change may have been obvious, but in other instances this change was not as apparent. Also, admissions for evaluation often occur simultaneously with other events (i.e. surgery, active medical treatment, etc.), and so it is often difficult to separate out a single reason for admission. A distinction which caused particular difficulty was distinguishing between surgery for diagnostic evaluation and surgery for cancer treatment. A comprehensive list of which procedures fall into which category would be necessary to implement this approach.

In general, the resource-based purpose typology was a useful way to characterize hospital admissions for these three types of cancers. Further work should focus on refining reason for admission categories and also considering disease stage and other indicators of severity to describe patients since these could affect resource use. Patient and family choices about treatment options, such as DNR status and its timing, also require exploration. In this study, accurate disease staging was not available on all patient records and therefore could not be used reliably to differentiate cases. The implications of future work in this area should also examine the outpatient costs associated with caring for this type of patient, especially as hospitals move to provide more diagnostic tests, biopsies, surgeries, and treatments such as chemotherapy on an outpatient basis. This is often problematic since it is difficult to link patient specific inpatient and outpatient data together. Moreover, by relying on institutional based data, by definition one is limited to the care that is provided by that institution only, unable to capture doctors' office visits and diagnostic testing performed at another free-standing laboratory or radiology centers.

POLICY IMPLICATIONS

The major goal of this study was to test whether a purpose of admission typology could be successfully used to categorize cancer cases in three common cancers: lung, colon and breast cancer. The first phase of this study, which examined a 20 percent sample of Medicare inpatient hospital data on discharges from FY1984, indicated that these cancers were among the most common in the Medicare population and accounted for a large proportion of expenditures. Lung cancer was coded as the most common primary site (15 percent of cancer-related discharges) and these discharges accounted for the greatest proportion of total charges among all cancers (15 percent or $158 million). Colon cancer ranked third as a primary site (9.9 percent of total discharges) and second in proportion of total charges accounted for (14 percent or $148 million). Breast cancer as a primary site ranked fourth in frequency (9 percent of total discharges) and these discharges accounted for 6.6 percent of total charges ($68 million).

We focused on the development and testing of a purpose of admission typology for several reasons. First, other grouping variables had been shown to be less predictive than the DRGs in classifying hospitalization costs. An early component of this study revealed that grouping cancer discharges by primary anatomical site of the cancer was much less successful in creating iso-resource groups than the DRGs. Other researchers had examined several clinical severity measures and type/stage of tumor with mixed success. Second, intuitively, purpose of admission should be related to resource use for cancer cases due to the clinical characteristics of the disease itself (i.e., much cancer care follows a pattern of diagnostic work-up, treatment and, if treatment is unsuccessful, palliation), the treatment modalities used to treat the disease, and the discretionary nature of some, more aggressive treatments and therapies.

The purpose of admission typology was tested on two data bases: a 20 percent sample of Medicare discharges from the FY1985 Medpar file and a sample of over 700 cases abstracted from medical charts in five Boston area hospitals. The typology was developed such that it relied only on data available in the Medpar file. The medical chart review data was used primarily to ascertain whether reviewers could determine the purpose of admission early on in the admission, whether other variables not available in the Medpar data (e.g., initial versus subsequent admission, DNR status, purpose of admission change), made a difference in resource cost. The major research findings for each section of the study have been summarized earlier in this report. This final section will discuss the policy implications of these results.

First, this research demonstrated that secondary data can be used successfully to model purpose of admission. This assertion is supported by three facts: 1) the ability of the researchers to develop criteria to classify cases into the purpose groups using reading available Medpar data; 2) the "face validity" of the purpose group classification when cross-tabulated with the DRGs; and 3) the similarity of the proportions falling into the purpose groups for each cancer between the Medpar and medical chart review analyses.

Second, the DRGs vary by cancer type in their ability to group discharges with similar resource costs. For both lung and colon cancer, the DRGs explained roughly 26 percent of the variation in total charges while for breast cancer the amount explained was only 15 percent. An explanation for this finding is that surgical and medical care for breast cancer patients have similar costs. Thus, the medical surgical aspect embodied in the DRGs has less impact on explaining charge variation. For lung and colon cancer, however, it appears that, overall, the DRGs are performing adequately in explaining resource variation.

Third, across all cases, the purpose of admission groups were able to achieve some improvement over the DRGs for lung and breast cancer but not for for colon cancer. Most of the explanatory power of the DRGs and the purpose groups derives from the separate classification of medical and surgical cases. Once this split is made, it appears that the purpose groups do not greatly add to explaining the variation within the medical and surgical categories.

Two important exceptions involve DRG 410, chemotherapy, and the medical malignancy DRGs. Cases classified into DRG 410 which were placed into active treatment with diagnostic evaluation category had consistently higher costs than those placed in the other major purpose group for 410, active treatment without diagnostic evaluation. Only accounting for roughly only 10 percent of cases in DRG 410 for each cancer, the extra diagnostic services delivered during these admissions caused significant increases in cost. These cases are likely to be DRG 410 "losers" for hospitals. If the hospital is able to shift these diagnostic services to the outpatient setting, reimbursement for these cases will become more favorable. If there are clinical or socioeconomic reasons, however, why these patients cannot be worked up in an outpatient setting which are systematically related to hospital characteristics (e.g., location or auspice), reimbursement inequities could result.

Similarly, cases in medical malignancy DRGs have higher resource costs when the purpose of admission is coded into an active treatment category than when the admission is for diagnostic evaluation only or for palliation. This finding is not necessarily problematic unless there is a systematic relationship between the type of hospital and the relative proportion of medical malignancy discharges admitted for these different purposes. Clearly, more research is needed both to learn more about the types of admissions which are higher cost in the chemotherapy and medical malignancy DRGs and to analyze the distribution across hospitals of these higher cost cases.

Fourth, the results of this study provided preliminary evidence of hospital differences in the purpose of admission across the three cancers. Public hospitals were somewhat more likely to admit patients for palliative care and for diagnostic evaluation only and less likely to admit for expensive procedures, such as surgery. It is not clear if these differences are due to a more clinically severe or otherwise different casemix or to practice differences. In any case, further investigation is warranted.

Fifth, the medical chart review results show that important information which is significantly related to resource use is now not available on the hospital discharge abstract. For two of the cancers studied (lung and colon) the initial admission was more expensive than subsequent admissions. While not true for breast cancer, this finding may hold for other cancers or for cancer discharges as a whole.

It is hoped that this study provides some insight into how cancer discharges are distributed in the Medicare population, the strengths and weakness of the current DRG system in grouping cancer discharges, what may be fruitful future directions to pursue in improving this reimbursement system.

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Table 4

Number of Cases, Percent of Total Cases, and Total Charge by Admission Group

Lung Cancer

Admission Group	N	% of Total	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Palliation	5264	24.16%	$3,656	$2,888	$202	$20,237	$3,244
Major Surgery w/ Dx Eval	1473	6.76%	$10,174	$9,738	$321	$20,242	$4,530
Major Surgery w/o Dx Eval	825	3.79%	$9,389	$8,928	$792	$20,148	$4,349
Active Treat. w/ Dx Eval	1924	8.83%	$6,337	$5,187	$400	$20,240	$4,229
Active Treat. w/o Dx Eval	4199	19.27%	$3,080	$2,076	$204	$20,128	$2,925
Dx Eval Only	8103	37.19%	$4,846	$3,767	$248	$20,230	$3,800
All Groups	21788	100.00%	$4,882	$3,480	$202	$20,242	$4,132

Table 5

Number of Cases, Percent of Total Cases, and Per Diem Charge by Admission Group

Lung Cancer

	Charge Per Day						
Admission Group	N	% of Total	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Palliation	3634	20.67%	$466	$427	$25	$2,571	$252
Major Surgery w/ Dx Eval	1239	7.05%	$875	$799	$153	$4,276	$380
Major Surgery w/o Dx Eval	689	3.92%	$872	$789	$182	$4,543	$428
Active Treat. w/ Dx Eval	1586	9.02%	$888	$610	$132	$4,182	$348
Active Treat. w/o Dx Eval	3720	21.16%	$894	$759	$161	$6,336	$521
Dx Eval Only	6712	38.18%	$659	$574	$36	$4,219	$353
All Groups	17580	100.00%	$699	$598	$25	$6,336	$410

Table 8

Number of Cases, Percent of Total Cases, and Length of Stay by Admission Group

Lung Cancer

			Length of Stay (days)				
Admission Group	N	% of Total	Mean	Median	Minimum	Maximum	Standard Deviation
Palliation	5264	24.16%	8.3	6.0	1	89	8
Major Surgery w/ Dx Eval	1473	6.76%	13.3	12.0	1	54	7
Major Surgery w/o Dx Eval	825	3.79%	12.2	11.0	1	55	7
Active Treat. w/ Dx Eval	1924	8.83%	10.8	9.0	1	58	8
Active Treat. w/o Dx Eval	4199	19.27%	4.7	3.0	1	58	5
Dx Eval Only	8103	37.19%	8.5	7.0	1	78	7
All Groups	21788	100.00%	8.4	7.0	1	89	7

Table 7

Mean Total Charge and Proportion of Admissions by Admission Group and Diagnostic Category

Lung Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
DRG410 (Chemo)	--		--		--		$3,179	11.6%	$2,026	85.6%	--		$2,113	13.9%
DRG075 (Major Chest Procs)	--		$10,754	79.6%	$9,671	86.9%	$9,451	1.1%	$6,606	.0%	--		$10,327	8.2%
DRG078:077 (O.R. Procs)	--		$8,750	13.0%	$6,646	3.6%	$7,943	8.1%	$8,434	.1%	$5,966	11.3%	$6,618	5.9%
DRG082 (Resp Malig)	$3,619	69.2%	--		--		$6,656	62.3%	$5,101	23.2%	$4,706	72.2%	$4,597	53.9%
MDC4, Medical	$3,912	16.2%	--		--		$6,350	6.2%	$5,107	6.2%	$4,468	6.7%	$4,424	7.6%
Other MDC, Medical	$3,672	16.5%	--		$8,820	.7%	$6,498	9.3%	$4,740	5.9%	$3,959	9.0%	$4,134	9.1%
MDC4, Surgical	--		--		--		--		--		--		--	
Other MDC, Surgical	--		$8,128	7.4%	$8,738	9.6%	$3,994	1.3%	$6,436	.0%	$4,017	.9%	$6,866	1.2%
All Cases	$3,666	100.0%	$10,299	100.0%	$9,449	100.0%	$6,319	100.0%	$3,089	100.0%	$4,760	100.0%	$4,812	100.0%

Table 8

Proportion of Admissions, by Admission Group and DRG

Lung Cancer

Admission Group	DRG410 (Chemo)	DRG075 (Major Chest Procs)	DRG076+077 (O.R. Procs)	DRG082 (Resp Malig)	All Groups
Palliation				31.6%	20.7%
Mean Charge	--	--	--	$3,619	$3,619
Length of Stay	--	--	--	8	8
Major Surgery w/ Dx Eval		57.6%	13.8%		7.0%
Mean Charge	--	$10,754	$8,750	--	$10,472
Length of Stay	--	13	12	--	13
Major Surgery w/o Dx Eval		35.7%	2.3%		3.9%
Mean Charge	--	$9,671	$6,646	--	$9,544
Length of Stay	--	12	12	--	12
Active Treat. w/ Dx Eval	7.5%	1.1%	12.2%	10.3%	9.0%
Mean Charge	$3,179	$9,451	$7,943	$6,858	$6,331
Length of Stay	4	11	12	12	11
Active Treat. w/o Dx Eval					21.2%
Mean Charge	$2,028	$6,606	$8,434	$5,101	$2,836
Length of Stay	3	6	11	9	4
Dx Eval Only					38.2%
Mean Charge	--	$9,161	$5,986	$4,706	$4,941
Length of Stay	--	12	9	8	9
All Cases	100.0%	100.0%	100.0%	100.0%	100.0%
Mean Charge	$2,113	$10,263	$6,616	$4,597	$4,918
Length of Stay	3	13	10	9	8

Table 9

Mean Total Charge and Proportion of Admissions by Age and Admission Group

Lung Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Age	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
65 - 74	$3,690	62.2%	$10,344	74.1%	$9,583	71.8%	$6,295	68.0%	$3,015	77.4%	$4,961	64.2%	$4,952	67.6%
75 - 84	$3,579	32.4%	$9,804	24.4%	$8,984	26.4%	$6,372	29.0%	$3,246	21.0%	$4,843	31.0%	$4,757	28.6%
GE 85	$3,750	5.4%	$7,886	1.8%	$6,806	1.8%	$6,949	3.0%	$4,032	1.6%	$4,612	4.7%	$4,565	3.8%
All Ages	$3,858	100.0%	$10,174	100.0%	$9,369	100.0%	$6,337	100.0%	$3,080	100.0%	$4,846	100.0%	$4,882	100.0%

Table 10

Mean Total Charge and Proportion of Admissions by Admission Group and Type of Secondary Diagnosis Group

Lung Cancer

Secondary Diagnosis Type	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
No Comp/Dist /Comorbid	$3,508	7.2%	$9,331	13.2%	$9,005	18.1%	$5,381	3.6%	$4,349	2.2%	$4,062	9.3%	$5,081	7.5%
Complic only	$3,348	10.3%	$9,130	5.0%	$8,360	4.8%	$4,358	8.4%	$2,048	27.3%	$3,925	6.3%	$3,184	11.4%
Distant only	$2,818	10.8%	$8,398	9.1%	$7,547	12.5%	$5,897	9.9%	$4,021	3.8%	$3,885	12.1%	$4,250	9.8%
Comorbid only	$3,448	9.3%	$10,463	26.2%	$9,527	28.6%	$6,120	10.1%	$5,008	2.8%	$4,530	17.6%	$5,690	13.1%
Complic & Distant	$3,504	11.2%	$10,776	4.3%	$9,094	4.0%	$5,435	11.3%	$2,540	23.2%	$5,201	6.5%	$3,927	11.1%
Complic & CoMorbid	$4,097	20.5%	$11,321	15.4%	$10,374	13.0%	$6,940	19.6%	$3,573	16.7%	$5,323	18.1%	$5,278	18.6%
Distant & CoMorbid	$3,831	14.9%	$9,877	17.6%	$9,827	12.6%	$6,725	16.7%	$5,328	5.6%	$5,216	16.6%	$5,580	14.9%
Comp+Dist +Comorbid	$4,004	15.7%	$11,248	9.2%	$11,283	6.2%	$7,312	18.1%	$3,541	16.7%	$5,935	11.5%	$5,334	13.7%
All Cases	$3,656	100.0%	$10,174	100.0%	$9,369	100.0%	$6,337	100.0%	$3,080	100.0%	$4,846	100.0%	$4,882	100.0%

Mean Total Charge and Proportion of Admissions by Admission Group and Discharge Status

Lung Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Discharge Status	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Alive	$3,700	64.5%	$10,071	94.4%	$9,352	93.6%	$5,960	85.8%	$2,770	89.2%	$4,707	85.8%	$4,843	82.2%
Dead	$3,580	35.5%	$11,905	5.6%	$9,615	6.4%	$8,617	14.2%	$5,649	10.8%	$5,681	14.2%	$5,059	17.8%
Total Cases	$3,658	100.0%	$10,174	100.0%	$9,369	100.0%	$6,337	100.0%	$3,080	100.0%	$4,846	100.0%	$4,882	100.0%

Table 12

Mean Total Charge and Proportion of Admissions by Admission Group and Hospital Bedsize

Lung Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Number of Beds	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
LT 100	$3,042	16.7%	$10;378	3.0%	$9,984	3.6%	$5,751	3.6%	$3,043	5.1%	$3,547	6.0%	$3,567	9.1%
100 - 299	$3,521	38.3%	$9,922	32.9%	$9,208	35.4%	$8,381	28.1%	$2,965	34.1%	$4,746	36.9%	$4,704	35.8%
300 - 500	$3,750	28.4%	$10,825	34.1%	$9,598	32.8%	$8,177	35.2%	$3,168	33.5%	$5,122	31.2%	$5,130	31.1%
GT 500	$4,517	16.6%	$9,919	30.0%	$9,224	28.1%	$6,533	33.1%	$3,103	27.2%	$5,074	23.9%	$5,319	24.2%
All Cases	$3,858	100.0%	$10,174	100.0%	$9,389	100.0%	$6,337	100.0%	$3,080	100.0%	$4,846	100.0%	$4,882	100.0%

Table 15

Mean Total Charge and Proportion of Admissions by Hospital Control and Admission Group

Lung Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Hospital Control	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Non Profit	$3,767	72.5%	$10,114	61.0%	$9,410	81.1%	$6,281	78.1%	$3,026	79.1%	$4,900	75.6%	$4,946	76.3%
Proprietary	$4,024	8.8%	$11,134	8.5%	$9,589	8.8%	$6,782	8.1%	$3,534	9.5%	$5,345	10.0%	$5,303	9.3%
Public	$3,058	18.7%	$9,885	10.5%	$8,858	10.1%	$8,408	13.8%	$3,071	11.3%	$4,213	14.4%	$4,265	14.3%
All Hospitals	$3,858	100.0%	$10,174	100.0%	$9,389	100.0%	$8,337	100.0%	$3,080	100.0%	$4,848	100.0%	$4,882	100.0%

Table 14

Mean Total Charge and Proportion of Admissions by Admission Group and MSA Type

Lung Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
MSA Type	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Rural	$2,972	28.0%	$8,823	10.7%	$9,029	13.7%	$4,961	11.5%	$2,809	11.8%	$3,593	16.1%	$3,708	17.3%
Urban	$3,924	72.0%	$10,336	89.3%	$9,422	86.3%	$6,516	88.5%	$3,116	88.2%	$5,086	83.9%	$5,127	82.7%
All Cases	$3,658	100.0%	$10,174	100.0%	$9,369	100.0%	$6,337	100.0%	$3,080	100.0%	$4,846	100.0%	$4,882	100.0%

Table 15

Number of Cases, Percent of Total Cases, and Total Charge by Admission Group

Colon Cancer

Admission Group	N	% of Total	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Palliation	1416	8.45%	$3,736	$2,585	$217	$26,625	$3,604
Major Surgery w/ Dx Eval	4393	26.21%	$9,797	$8,751	$339	$27,350	$5,098
Major Surgery w/o Dx Eval	7025	41.92%	$9,394	$6,144	$426	$27,326	$5,031
Active Treat. w/ Dx Eval	315	1.88%	$5,381	$3,614	$780	$25,693	$4,850
Active Treat. w/o Dx Eval	1082	6.46%	$3,375	$1,957	$234	$25,637	$3,889
Dx Eval Only	2527	15.08%	$3,902	$2,516	$232	$26,715	$3,985
All Groups	16758	100.00%	$7,730	$6,721	$217	$27,350	$5,431

Table 16

Number of Cases, Percent of Total Cases, and Per Diem Charge by Admission Group

Colon Cancer

			Charge Per Day				
Admission Group	N	% of Total	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Palliation	1037	7.13%	$394	$348	$39	$1,832	$197
Major Surgery w/ Dx Eval	3792	26.06%	$696	$637	$141	$4,543	$294
Major Surgery w/o Dx Eval	6595	45.35%	$707	$636	$36	$9,645	$386
Active Treat. w/ Dx Eval	261	1.79%	$637	$547	$171	$2,589	$336
Active Treat. w/o Dx Eval	989	6.66%	$594	$476	$149	$4,146	$389
Dx Eval Only	1887	12.98%	$540	$471	$8	$2,594	$273
All Groups	14541	100.00%	$652	$591	$8	$9,845	$341

Table 17

Number of Cases, Percent of Total Cases, and Length of Stay by Admission Group

Colon Cancer

Admission Group	N	% of Total	Length of Stay (days) Mean	Median	Minimum	Maximum	Standard Deviation
Palliation	1416	8.45%	10.2	7.0	1	91	11
Major Surgery w/ Dx Eval	4393	26.21%	14.9	14.0	1	96	7
Major Surgery w/o Dx Eval	7025	41.92%	14.1	12.0	1	153	7
Active Treat. w/ Dx Eval	315	1.88%	9.4	7.0	1	49	8
Active Treat. w/o Dx Eval	1082	6.46%	6.5	4.0	1	156	9
Dx Eval Only	2527	15.08%	7.9	5.0	1	67	6
All Groups	16758	100.00%	12.5	11.0	1	156	8

Table 18

Mean Total Charge and Proportion of Admissions by Admission Group and Diagnostic Category

Colon Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
DRG410 (Chemo)	--		--		--		$2,865	11.9%	$1,937	60.5%	--		$1,987	4.1%
DRG146+147 (Rectal Resec)	--		$11,157	15.2%	$10,378	20.9%	--		--		--		$10,822	12.7%
DRG148+149 (S+L Bowel Procs)	--		$10,146	72.3%	$9,250	73.9%	--		--		--		$9,596	49.9%
DRG172+173 (Diges Mailg)	$3,535	73.5%	--		--		$5,435	72.0%	$5,552	29.9%	$3,740	75.5%	$4,046	20.9%
MDC5, Medical	$3,320	6.7%	--		--		$6,671	1.9%	$7,461	1.0%	$3,159	5.5%	$3,454	1.5%
Other MDC, Medical	$3,520	19.5%	--		--		$5,797	5.4%	$5,177	6.0%	$3,515	13.4%	$3,600	4.2%
MDC5, Surgical	--		$5,755	11.1%	$5,640	4.5%	$10,470	4.2%	$4,140	1.5%	$7,662	4.5%	$5,325	5.7%
Other MDC, Surgical	--		$9,829	1.3%	$10,245	.7%	$5,125	1.8%	$4,367	1.1%	$8,475	.8%	$8,855	.8%
All Cases	$3,741	100.0%	$9,809	100.0%	$9,360	100.0%	$5,389	100.0%	$3,326	100.0%	$3,887	100.0%	$7,718	100.0%

Table 19

Proportion of Admissions, by Admission Group and DRG

Colon Cancer

	DRG410 (Chemo)	DRG146+147 (Rectal Resec)	DRG148+149 (S+L Bowel Procs)	DRG172+173 (Diges Malig)	All Groups
Palliation				29.9%	7.1%
Mean Charge	--	--	--	$3,838	$3,838
Length of Stay	--	--	--	11	11
Major Surgery w/ Dx Eval		31.3%	37.8%		26.1%
Mean Charge	--	$11,157	$10,146	--	$10,322
Length of Stay	--	16	15	--	16
Major Surgery w/o Dx Eval		68.8%	62.2%		45.4%
Mean Charge	--	$10,378	$9,260	--	$9,506
Length of Stay	--	15	14	--	14
Active Treat. w/ Dx Eval	5.4%			6.5%	1.8%
Mean Charge	$2,865	--	--	$5,435	$5,071
Length of Stay	5	--	--	9	9
Active Treat. w/o Dx Eval					6.7%
Mean Charge	$1,937	--	--	$5,552	$3,131
Length of Stay	4	--	--	11	6
Dx Eval Only					13.0%
Mean Charge	--	--	--	$3,740	$3,740
Length of Stay	--	--	--	8	8
All Cases	100.0%	100.0%	100.0%	100.0%	100.0%
Mean Charge	$1,987	$10,622	$9,596	$4,046	$8,062
Length of Stay	4	15	15	9	13

Table 20

Mean Total Charge and Proportion of Admissions by Age and Admission Group

Colon Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Age	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
65 - 74	$3,704	46.5%	$9,526	47.1%	$8,898	47.1%	$5,347	49.2%	$2,969	59.3%	$3,868	42.1%	$7,401	47.1%
75 - 84	$3,798	39.6%	$9,963	39.9%	$9,695	40.1%	$5,515	33.0%	$3,948	33.2%	$4,134	38.6%	$8,058	39.2%
GE 85	$3,884	13.8%	$10,270	13.0%	$10,284	12.7%	$5,223	17.6%	$4,057	7.5%	$3,513	19.3%	$7,921	13.6%
All Ages	$3,738	100.0%	$9,797	100.0%	$9,394	100.0%	$5,381	100.0%	$3,373	100.0%	$3,902	100.0%	$7,730	100.0%

Table 21

Mean Total Charge and Proportion of Admissions by Admission Group and Type of Secondary Diagnosis Group

Colon Cancer

Secondary Diagnosis Type	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
No Comp/Dist /Comorbid	$4,504	7.4%	$7,885	9.3%	$7,420	14.8%	$2,810	10.8%	$3,459	5.1%	$2,848	8.3%	$8,830	11.1%
Complic only	$2,886	8.6%	$9,665	2.7%	$10,019	3.0%	$6,099	4.4%	$2,173	16.1%	$3,187	5.3%	$5,982	4.4%
Distant only	$2,745	17.5%	$8,623	9.4%	$8,285	9.9%	$4,665	9.2%	$4,417	6.3%	$3,320	10.7%	$6,578	10.3%
Comorbid only	$4,327	8.7%	$9,189	31.2%	$8,740	30.8%	$4,235	21.3%	$4,665	6.4%	$3,421	20.7%	$7,978	25.7%
Complic & Distant	$3,769	16.9%	$10,526	3.7%	$10,916	2.6%	$6,620	12.1%	$2,314	34.1%	$4,481	7.8%	$5,816	7.1%
Complic & CoMorbid	$4,266	12.2%	$11,324	14.8%	$11,780	13.8%	$7,399	12.1%	$4,888	10.1%	$4,396	17.2%	$9,348	14.0%
Distant & CoMorbid	$3,561	16.5%	$10,070	20.7%	$9,890	18.4%	$6,081	14.0%	$6,213	7.1%	$4,156	17.1%	$8,342	17.8%
Comp+Dist +Comorbid	$4,180	16.2%	$11,898	8.2%	$12,088	6.8%	$6,730	16.2%	$3,705	14.9%	$4,797	13.0%	$8,425	9.8%
All Cases	$3,736	100.0%	$9,797	100.0%	$9,394	100.0%	$5,381	100.0%	$3,375	100.0%	$3,902	100.0%	$7,730	100.0%

Table 22

Mean Total Charge and Proportion of Admissions by Admission Group and Discharge Status

Colon Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Discharge Status	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Alive	$3,627	64.1%	$9,604	94.8%	$9,245	96.1%	$4,694	87.9%	$3,056	93.0%	$3,736	85.3%	$7,740	91.1%
Dead	$3,932	35.9%	$13,306	5.2%	$13,061	3.9%	$10,384	12.1%	$7,606	7.0%	$4,870	14.7%	$7,622	8.9%
Total Cases	$3,736	100.0%	$9,797	100.0%	$9,394	100.0%	$5,381	100.0%	$3,375	100.0%	$3,902	100.0%	$7,730	100.0%

Table 23

Mean Total Charge and Proportion of Admissions by Admission Group and Hospital Bedsize

Colon Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Number of Beds	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
LT 100	$3,010	22.0%	$9,204	9.7%	$8,695	12.7%	$4,956	10.8%	$3,200	8.4%	$2,810	19.5%	$6,391	13.4%
100 299	$3,888	40.2%	$9,703	38.9%	$9,289	39.0%	$5,073	33.0%	$3,267	39.3%	$3,740	38.9%	$7,615	38.9%
300 - 500	$3,989	23.2%	$9,924	29.7%	$9,408	29.2%	$4,884	32.7%	$3,216	27.5%	$4,493	24.1%	$8,041	28.0%
GT 500	$4,562	14.6%	$10,058	21.7%	$10,055	19.1%	$8,700	23.5%	$3,784	24.8%	$4,889	17.5%	$8,428	19.8%
All Cases	$3,736	100.0%	$9,797	100.0%	$9,394	100.0%	$5,381	100.0%	$3,375	100.0%	$3,902	100.0%	$7,730	100.0%

Table 24

Mean Total Charge and Proportion of Admissions by Hospital Control and Admission Group

Colon Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Hospital Control	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Non Profit	$3,873	75.0%	$9,677	77.0%	$9,297	78.1%	$5,194	77.5%	$3,455	74.1%	$4,063	72.9%	$7,753	76.5%
Proprietary	$3,995	8.3%	$11,359	10.7%	$11,201	8.7%	$6,747	9.2%	$3,644	9.2%	$3,969	10.2%	$8,987	9.5%
Public	$2,998	16.7%	$9,186	12.3%	$8,776	13.1%	$5,522	13.3%	$2,799	16.7%	$3,189	16.9%	$6,748	14.0%
All Hospitals	$3,736	100.0%	$9,797	100.0%	$9,394	100.0%	$5,381	100.0%	$3,362	100.0%	$3,902	100.0%	$7,729	100.0%

Table 25

Mean Total Charge and Proportion of Admissions by Admission Group and MSA Type

Colon Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
MSA Type	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Rural	$2,650	27.5%	$8,545	18.4%	$8,150	20.2%	$4,504	13.3%	$2,560	15.0%	$2,572	26.6%	$6,251	20.8%
Urban	$4,148	72.5%	$10,081	81.6%	$9,708	79.8%	$5,516	86.7%	$3,519	85.0%	$4,385	73.4%	$8,119	79.2%
All Cases	$3,736	100.0%	$9,797	100.0%	$9,394	100.0%	$5,381	100.0%	$3,375	100.0%	$3,902	100.0%	$7,730	100.0%

Table 26

Number of Cases, Percent of Total Cases, and Total Charge by Admission Group

Breast Cancer

Admission Group	N	% of Total	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Palliation	513	5.55%	$3,521	$2,740	$220	$13,392	$2,858
Major Surgery w/ Dx Eval	3247	35.13%	$4,394	$3,936	$504	$13,500	$2,045
Major Surgery w/o Dx Eval	3897	42.16%	$3,760	$3,357	$316	$13,455	$1,854
Active Treat. w/ Dx Eval	184	1.99%	$4,476	$3,454	$670	$13,412	$2,997
Active Treat. w/o Dx Eval	433	4.68%	$2,351	$1,668	$217	$13,287	$2,197
Dx Eval Only	970	10.49%	$3,030	$2,352	$228	$13,335	$2,334
All Groups	9244	100.00%	$3,841	$3,418	$217	$13,500	$2,154

Table 27

Number of Cases, Percent of Total Cases, and Per Diem Charge by Admission Group

Breast Cancer

	Charge Per Day						
Admission Group	N	% of Total	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Palliation	355	4.22%	$430	$383	$55	$1,395	$198
Major Surgery w/ Dx Eval	3202	38.02%	$658	$598	$166	$2,918	$277
Major Surgery w/o Dx Eval	3787	44.97%	$651	$581	$82	$4,775	$305
Active Treat. w/ Dx Eval	92	1.09%	$626	$570	$258	$1,733	$305
Active Treat. w/o Dx Eval	336	3.99%	$633	$549	$189	$3,542	$360
Dx Eval Only	649	7.71%	$639	$548	$164	$2,116	$346
All Groups	8421	100.00%	$642	$576	$55	$4,775	$300

Table 28

Number of Cases, Percent of Total Cases, and Length of Stay by Admission Group

Breast Cancer

Admission Group	N	% of Total	Length of Stay (days)				
			Mean	Median	Minimum	Maximum	Standard Deviation
Palliation	513	5.55%	9.3	7.0	1	62	8
Major Surgery w/ Dx Eval	3247	35.13%	7.4	7.0	1	42	4
Major Surgery w/o Dx Eval	3897	42.16%	6.5	6.0	1	36	4
Active Treat. w/ Dx Eval	184	1.99%	8.4	6.0	1	42	7
Active Treat. w/o Dx Eval	433	4.68%	4.4	3.0	1	43	5
Dx Eval Only	970	10.49%	5.9	4.0	1	54	5
All Groups	9244	100.00%	6.8	6.0	1	62	5

Table 29

Mean Total Charge and Proportion of Admissions by Admission Group and Diagnostic Category

Breast Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
DRG410 (Chemo)	--		--		--		$2,551	8.7%	$1,436	59.2%	--		$1,502	2.9%
DRG257+258 (Ttl Mastectomy)	--		$4,499	63.6%	$3,876	84.1%	--		--		--		$4,158	64.8%
DRG259+260 (Sub Mastectomy)	--		$3,510	15.4%	$2,795	13.5%	$5,093	11.5%	--		$3,069	25.2%	$3,199	14.0%
DRG274+275 (Malig Breast)	$3,493	69.3%	--		--		$5,524	30.1%	$3,644	18.8%	$3,029	42.0%	$3,439	9.7%
MDC9, Medical	$3,483	.4%	--		--		--		$2,432	.2%	$1,621	.2%	$2,528	.1%
Other MDC, Medical	$3,573	30.3%	--		--		$4,707	24.6%	$3,900	14.8%	$3,066	21.6%	$3,501	5.1%
MDC9, Surgical	--		$5,001	.5%	$3,706	1.3%	$3,241	12.6%	$2,642	3.7%	$2,577	8.8%	$3,160	2.1%
Other MDC, Surgical	--		$7,752	.6%	$5,611	1.0%	$3,141	12.6%	$2,955	3.2%	$3,607	2.2%	$4,797	1.3%
All Cases	$3,517	100.0%	$4,384	100.0%	$3,745	100.0%	$4,427	100.0%	$2,351	100.0%	$3,017	100.0%	$3,629	100.0%

Table 30

Proportion of Admissions, by Admission Group and DRG

Breast Cancer

	DRG410 (Chemo)	DRG257+258 (Ttl Mastectomy)	DRG259+260 (Sub Mastectomy)	DRG274+275 (Malig Breast)	All Groups
Palliation				39.6%	4.2%
Mean Charge	--	--	--	$3,493	$3,493
Length of Stay	--	--	--	9	9
Major Surgery w/ Dx Eval		45.3%	38.6%		38.0%
Mean Charge	--	$4,499	$3,610	--	$4,361
Length of Stay	--	8	6	--	7
Major Surgery w/o Dx Eval		54.7%	40.8%		45.0%
Mean Charge	--	$3,876	$2,795	--	$3,726
Length of Stay	--	7	4	--	6
Active Treat. w/ Dx Eval	5.9%		1.6%	6.1%	1.1%
Mean Charge	$2,551	--	$5,093	$5,524	$4,908
Length of Stay	3	--	11	11	10
Active Treat. w/o Dx Eval					4.0%
Mean Charge	$1,436	--	--	$3,844	$2,017
Length of Stay	3	--	--	7	4
Dx Eval Only					7.7%
Mean Charge	--	--	$3,069	$3,029	$3,044
Length of Stay	--	--	5	6	6
All Cases	100.0%	100.0%	100.0%	100.0%	100.0%
Mean Charge	$1,502	$4,158	$3,199	$3,439	$3,850
Length of Stay	3	7	5	8	7

Table 31

Mean Total Charge and Proportion of Admissions by Age and Admission Group

Breast Cancer

Age	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
65 - 74	$3,665	52.6%	$4,377	56.9%	$3,794	54.5%	$4,238	65.8%	$2,337	78.1%	$2,993	58.2%	$3,823	56.9%
75 - 84	$3,242	35.3%	$4,444	34.8%	$3,801	34.9%	$4,819	26.6%	$2,354	18.5%	$3,104	32.0%	$3,911	33.6%
GE 85	$3,707	12.1%	$4,299	8.3%	$3,456	10.7%	$5,331	7.6%	$2,653	3.5%	$3,013	9.8%	$3,703	9.4%
All Ages	$3,521	100.0%	$4,394	100.0%	$3,760	100.0%	$4,476	100.0%	$2,351	100.0%	$3,030	100.0%	$3,841	100.0%

Table 32

Mean Total Charge and Proportion of Admissions by Admission Group and Type of Secondary Diagnosis Group

Breast Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Secondary Diagnosis Typè	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
No Comp/Dist /Comorbid	$3,835	11.7%	$3,781	27.7%	$3,425	36.5%	$3,071	5.7%	$3,116	4.4%	$2,338	15.5%	$3,480	27.5%
Complic only	$3,038	3.6%	$4,757	1.1%	$4,373	1.7%	$2,722	13.6%	$1,624	28.5%	$3,145	3.9%	$2,957	3.2%
Distant only	$2,977	20.9%	$4,012	14.8%	$3,588	13.4%	$4,211	14.7%	$3,605	6.1%	$2,909	17.4%	$3,518	14.5%
Comorbid only	$3,553	7.6%	$4,377	30.5%	$3,732	30.9%	$2,697	8.4%	$3,945	2.3%	$2,569	16.9%	$3,912	26.2%
Complic & Distant	$3,248	16.6%	$6,121	1.6%	$5,027	1.2%	$4,500	16.3%	$1,688	30.9%	$3,240	8.6%	$3,460	4.7%
Complic & CoMorbid	$3,098	6.6%	$5,649	4.0%	$5,023	3.9%	$6,499	7.1%	$2,824	5.5%	$3,673	6.7%	$4,735	4.5%
Distant & CoMorbid	$4,095	19.5%	$4,970	17.8%	$4,165	11.5%	$6,388	16.8%	$3,922	8.3%	$3,320	20.2%	$4,398	15.0%
Comp+Dist +Comorbid	$3,917	13.5%	$6,563	2.5%	$5,848	1.4%	$6,964	17.4%	$2,662	13.9%	$3,629	10.5%	$4,673	4.3%
All Cases	$3,521	100.0%	$4,394	100.0%	$3,760	100.0%	$4,478	100.0%	$2,381	100.0%	$3,030	100.0%	$3,541	100.0%

Table 33

Mean Total Charge and Proportion of Admissions by Admission Group and Discharge Status

Breast Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Discharge Status	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Alive	$3,613	73.3%	$4,391	99.8%	$3,757	99.8%	$4,226	92.4%	$2,096	94.0%	$3,022	90.8%	$3,841	97.0%
Dead	$3,267	26.7%	$5,554	.2%	$5,483	.2%	$7,491	7.6%	$6,347	6.0%	$3,111	9.2%	$3,833	3.0%
Total Cases	$3,521	100.0%	$4,394	100.0%	$3,760	100.0%	$4,476	100.0%	$2,351	100.0%	$3,030	100.0%	$3,841	100.0%

Table 34

Mean Total Charge and Proportion of Admissions by Admission Group and Hospital Bedsize

Breast Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Number of Beds	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
LT 100	$2,870	24.6%	$4,099	9.0%	$3,396	13.4%	$4,225	5.4%	$1,959	9.5%	$2,447	14.3%	$3,358	12.2%
100 - 299	$3,571	34.1%	$4,256	36.7%	$3,609	36.3%	$4,705	35.3%	$2,291	33.5%	$2,877	34.0%	$3,730	35.9%
300 - 500	$3,203	24.8%	$4,369	31.3%	$3,721	29.7%	$4,378	35.9%	$2,399	29.8%	$3,213	28.9%	$3,837	30.0%
GT 500	$4,656	16.6%	$4,763	23.0%	$4,323	20.6%	$4,339	23.4%	$2,509	27.3%	$3,393	22.6%	$4,301	21.6%
All Cases	$3,521	100.0%	$4,394	100.0%	$3,760	100.0%	$4,476	100.0%	$2,351	100.0%	$3,030	100.0%	$3,841	100.0%

Table 35

Mean Total Charge and Proportion of Admissions by Hospital Control and Admission Group

Breast Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
Hospital Control	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Non Profit	$3,571	78.2%	$4,377	77.4%	$3,776	78.3%	$4,242	79.9%	$2,291	79.4%	$3,127	75.1%	$3,847	77.7%
Proprietary	$4,610	7.6%	$5,046	9.9%	$4,196	7.9%	$6,256	6.5%	$2,619	7.4%	$3,030	10.0%	$4,384	8.8%
Public	$2,664	14.2%	$3,984	12.6%	$3,426	13.9%	$4,996	13.6%	$2,561	13.2%	$2,543	14.9%	$3,454	13.5%
All Hospitals	$3,521	100.0%	$4,394	100.0%	$3,760	100.0%	$4,476	100.0%	$2,351	100.0%	$3,030	100.0%	$3,841	100.0%

Table 36

Mean Total Charge and Proportion of Admissions by Admission Group and MSA Type

Breast Cancer

	Palliation		Major Surgery w/ Dx Eval		Major Surgery w/o Dx Eval		Active Treat. w/ Dx Eval		Active Treat. w/o Dx Eval		Dx Eval Only		All Groups	
MSA Type	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases	Mean Charge	% of Cases
Rural	$2,702	27.7%	$3,900	16.8%	$3,204	21.1%	$4,102	16.8%	$2,375	18.7%	$2,197	21.3%	$3,236	19.8%
Urban	$3,634	72.3%	$4,493	63.2%	$3,910	76.9%	$4,552	63.2%	$2,346	81.3%	$3,256	76.7%	$3,990	80.2%
All Cases	$3,521	100.0%	$4,394	100.0%	$3,760	100.0%	$4,476	100.0%	$2,351	100.0%	$3,030	100.0%	$3,841	100.0%

Table 37

VARIABLE DEFINITIONS AND EXPECTED EFFECTS ON RESOURCE USE

LUNG CANCER

Variable	Description
Patient Age	
Age 75-84	Dummy variables indicating patient age (age 65-74 group omitted[1])
Age 85 and over	
Presence/Type Secondary Diagnoses	
Metastatic disease	Dummy variables indicating type(s) of secondary diagnoses (Comorbidities and Complications group omitted[1])
Comorbidities	
Complications	
Metastatic disease and comorbidities	
Metastatic diseases and complications	
Metastatic disease, comorbidities, and complications	
None	
ADRG Group	
DRG410 (Chemotherapy)	Dummy variables indicating discharge DRG (DRG082 Respiratory Malignancy group omitted[1])
DRG075 (Major chest procedures)	
DRG076 + 077 (O.R. procedures)	
Purpose of Admission Groups	
Major surgery with diagnostic evaluation	Dummy variables indicating purpose of admission (Diagnostic evaluation only group omitted[1])
Major surgery without diagnostic evaluation	
Active treatment with diagnostic evaluation	
Active treatment without diagnostic evaluation	
Palliation	

---

[1] The omitted (or reference) group had the greatest number of cases for each variable.

Table 38

VARIABLE DEFINITIONS AND EXPECTED EFFECTS ON RESOURCE USE

COLON CANCER

Variable	Description
Patient Age	
Age 75-84	Dummy variables indicating patient age (age 65-74 group omitted)
Age 85 and over	
Presence/Type Secondary Diagnoses	
Metastatic disease	Dummy variables indicating type(s) of secondary diagnoses (Comorbidities group omitted[1])
Complications	
Metastatic disease and comorbidities	
Metastatic diseases and complications	
Comorbidities and complications	
Metastatic disease, comorbidities, and complications	
ADRG group	
None	
DRG410 (Chemotherapy)	Dummy variables indicating discharge DRG (DRG148 + 149 Small and Large Bowel Procedures group omitted[1])
DRG172 + 173 (Digestive Malignancy)	
DRG146 + 147 (Rectal Resection)	
Purpose of Admission Groups	
Major surgery without diagnostic evaluation	Dummy variables indicating purpose of admission (Major surgery with diagnostic evaluation group omitted[1])
Active treatment with diagnostic evaluation	
Active treatment without diagnostic evaluation	
Diagnostic evaluation only	
Palliation	

---

[1] The omitted (or reference) group had the greatest number of cases for each variable.

Table 39

VARIABLE DEFINITIONS AND EXPECTED EFFECTS ON RESOURCE USE

BREAST CANCER

Variable	Description
Patient Age	
Age 75-84 Age 85 and over	Dummy variables indicating patient age (age 65-74 group omitted)
Presence/Type Secondary Diagnoses	
Metastatic disease Comorbidities Complications Metastatic disease and comorbidities Metastatic diseases and complications Comorbidities and complications Metastatic disease, comorbidities, and complications	Dummy variables indicating type(s) of secondary diagnoses (None group omitted[1])
ADRG group	
DRG410 (Chemotherapy) DRG274 + 275 (Malignant breast disease) DRG259 + 260 (Subtotal mastectomy)	Dummy variables indicating discharge DRG (DRG257 + 258 Total Mastectomy omitted[1])
Purpose of Admission Groups:	
Major surgery without diagnostic evaluation Active treatment with diagnostic evaluation Active treatment without diagnostic evaluation Diagnostic evaluation only Palliation	Dummy variables indicating purpose of admission (Major surgery with diagnostic evaluation group omitted[1])

---

[1] The omitted (or reference) group had the greatest number of cases for each variable.

Table 40

ORDINARY LEAST SQUARES (OLS) RESULTS FOR LUNG CANCER

Variable	B	BETA	T	Sig. T
Patient Age				
Age 75-84	-190.17	-0.02	-4.36	<.001
Age 85 and over	-247.78	-0.01	-2.26	<.05
Presence/Type Secondary Diagnoses				
Metastatic disease	-1583.07	-0.12	-20.14	<.001
Comorbidities	-964.39	-0.08	-13.91	<.001
Complications	-883.28	-0.07	-11.32	<.001
Metastatic disease and comorbidities	-614.18	-0.05	-8.57	<.001
Metastatic disease and complications	-576.69	-0.04	-7.28	<.001
Metastatic disease, comorbidities and complications	52.85	0.01	0.71	.48
ADRG Group				
None	-1579.54	-0.12	-20.10	<.001
DRG410 (Chemotherapy)	-3441.58	-0.31	-36.25	<.001
DRG075 (Major chest procedures)	3846.63	0.28	25.02	<.001
DRG076 + 077 (O.R. procedures)	1402.33	0.09	17.15	<.001
Purpose of Admission Group				
Major surgery with diagnostic evaluation	2351.48	0.14	15.39	<.001
Major surgery without diagnostic evaluation	1416.67	0.06	8.07	<.001
Active treatment with diagnostic evaluation	1753.27	0.11	23.37	<.001
Active treatment without diagnostic evaluation	345.60	0.03	4.17	<.001
Palliation	-1015.80	-0.10	-18.93	<.001
Constant	5401.60			
N	30,907			
R^2	0.3137			
F(df)	830.87 (17)			
Signif F	<.001			

Table 41

ORDINARY LEAST SQUARES (OLS) RESULTS FOR COLON CANCER

Variable	B	BETA	T	Sig. T
Patient Age				
Age 75-84	435.14	0.04	6.87	<.001
Age 85 and over	713.21	0.04	7.69	<.001
Presence/Type Secondary Diagnoses				
Metastatic disease	-475.03	-0.03	-4.46	<.001
Complications	693.29	0.03	4.50	<.001
Metastatic disease and comorbidities	564.45	0.04	6.21	<.001
Metastatic disease and complications	1280.96	0.06	9.36	<.001
Comorbidities and complications	2189.94	0.13	21.87	<.001
Metastatic disease, comorbidities and complications	2259.80	0.12	19.61	<.001
ADRG Group				
None	-924.33	-0.06	-9.15	<.001
DRG410 (Chemotherapy)	-10228.33	-0.44	-42.73	<.001
DRG172 + 173 (Digestive malignancies)	-6533.31	-0.53	-66.57	<.001
DRG0146 + 147 (Rectal resection)	1212.49	0.08	13.66	<.001
Purpose of Admission Group				
Major surgery without diagnostic evaluation	-684.23	-0.06	-9.21	<.001
Major surgery with diagnostic evaluation	1900.06	0.05	8.34	<.001
Active treatment without diagnostic evaluation	1436.98	0.07	7.58	<.001
Diagnostic evaluation only	-596.29	-0.05	7.97	<.001
Palliation	68.22	0.003	0.53	.59
Constant	9311.68			
N	22,742			
R^2	0.3471			
F(df)	756.73 (17)			
Signif F	<.001			

Table 42

ORDINARY LEAST SQUARES (OLS) RESULTS FOR BREAST CANCER

Variable	B	BETA	T	Sig. T
Patient Age				
Age 75-84	-15.87	-0.003	-0.41	.68
Age 85 and over	-223.67	-0.03	-3.53	<.001
Presence/Type Secondary Diagnoses				
Metastatic disease	274.17	0.05	4.79	<.001
Comorbidities	439.46	0.09	9.16	<.001
Complications	844.68	0.07	7.03	<.001
Metastatic disease and comorbidities	925.47	0.15	15.93	<.001
Metastatic disease and complications	973.35	0.09	8.99	<.001
Comorbidities and complications	1458.00	0.14	15.50	<.001
Metastatic disease, comorbidities and complications	1583.25	0.14	15.55	<.001
ADRG Groups				
DRG410 (Chemotherapy)	-4120.70	-0.39	-19.31	<.001
DRG274 + 275 (Malignant breast disease)	-1129.41	-0.18	-8.65	<.001
DRG0259 + 260 (Subtotal mastectomy)	-888.45	-0.15	-15.50	<.001
Purpose of Admission Group				
Major surgery without diagnostic evaluation	-534.94	-0.12	-13.21	<.001
Active treatment with diagnostic evaluation	1347.14	0.07	6.80	<.001
Active treatment without diagnostic evaluation	425.95	0.05	2.23	<.05
Diagnostic evaluation only	-515.89	-0.07	4.58	<.001
Palliation	-185.94	-0.02	-1.23	.22
Constant	4073.38			
N	22,742			
R^2	12,312			
F(df)	128.19 (17)			
Signif F	<.001			

Number of Cases, Percent of Total Cases, and Total Charge by Admission Purpose Group

Breast Cancer

Admission Group	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Major Surgery w/ Dx Eval	39	13.31%	$13,300	$9,821	$3,189	$82,667	$13,931
Major Surgery w/o Dx Eval	16	5.46%	$8,590	$9,283	$2,663	$12,745	$2,931
Active Tx w/ Dx Eval	12	4.10%	$6,242	$4,405	$2,962	$18,865	$4,710
Active Tx w/o Dx Eval	34	11.60%	$3,911	$2,841	$585	$14,329	$2,732
Dx Eval Only	87	29.69%	$5,641	$3,840	$472	$34,853	$5,688
Palliation	93	31.74%	$4,673	$3,366	$289	$26,269	$4,506
Other	12	4.10%	$4,966	$3,422	$1,219	$13,329	$4,214
All Groups	293	100.00%	$6,332	$4,357	$289	$82,667	$7,274

Table [illegible]

Number of Cases, Percent of Total Cases, and Total Charge by Initial/Subsequent Admission Groups

Breast Cancer

Init/Sub Adm. Group	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
No	152	51.88%	$4,776	$3,527	$289	$26,954	$3,994
Yes	141	48.12%	$7,968	$6,318	$472	$82,687	$9,321
All Groups	293	100.00%	$6,332	$4,357	$289	$82,887	$7,274

Table 45

Number of Cases, Percent of Total Cases, and Total Charge by Initial/Subsequent Admission Groups

Breast Cancer

Init/Sub Adm. Group	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
No								
Mean Charge	$8,718	$7,345	$6,246	$4,044	$5,126	$4,133	$4,051	$4,776
% of Cases	4.6%	5.9%	5.3%	19.7%	14.5%	46.1%	3.9%	100.0%
N	7	9	8	30	22	70	6	152
Yes								
Mean Charge	$14,336	$10,190	$6,234	$2,963	$6,804	$6,222	$6,065	$7,968
% of Cases	22.7%	5.0%	2.8%	2.8%	46.1%	16.3%	4.3%	100.0%
N	32	7	4	4	65	23	6	141
All Cases								
Mean Charge	$13,300	$8,590	$6,242	$3,911	$6,641	$4,673	$4,966	$6,332
% of Cases	13.3%	5.5%	4.1%	11.6%	29.7%	31.7%	4.1%	100.0%
N	39	16	12	34	87	93	12	293

Table 46

Number of Cases, Percent of Total Cases, and Total Charge by DNR Status

Breast Cancer

DNR Status	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
Yes								
Mean Charge	$26,275	$5,918	$4,169	$4,512	$10,831	$5,098	$8,025	$6,276
% of Cases	3.1%	1.5%	4.6%	4.6%	9.2%	69.2%	7.7%	100.0%
N	2	1	3	3	6	45	5	65
No								
Mean Charge	$12,579	$8,768	$8,702	$3,651	$5,321	$4,276	$4,084	$6,347
% of Cases	16.2%	6.6%	3.9%	13.6%	36.5%	21.1%	3.1%	100.0%
N	37	15	9	31	61	48	7	228
All Cases								
Mean Charge	$13,300	$8,590	$6,242	$3,911	$5,641	$4,673	$4,966	$6,332
% of Cases	13.3%	6.6%	4.1%	11.6%	29.7%	31.7%	4.1%	100.0%
N	39	16	12	34	87	93	12	293

Mean Total Charge, Proportion of Admissions and Number of Cases by Death and Admission Purpose Groups

Breast Cancer

Dead?	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
Yes								
Mean Charge	$25,679	$5,918	$11,083	$4,695	$9,274	$3,988	$8,086	$7,296
% of Cases	7.7%	1.9%	5.8%	3.8%	17.3%	57.7%	5.8%	100.0%
N	4	1	3	2	9	30	3	52
No								
Mean Charge	$11,844	$8,768	$5,166	$3,881	$5,253	$4,987	$3,796	$6,133
% of Cases	14.5%	6.2%	3.7%	13.3%	32.4%	26.1%	3.7%	100.0%
N	35	15	9	32	78	63	9	241
All Cases								
Mean Charge	$13,300	$8,590	$6,248	$3,911	$5,641	$4,673	$4,966	$6,332
% of Cases	13.3%	5.5%	4.1%	11.6%	29.7%	31.7%	4.1%	100.0%
N	39	16	12	34	87	93	12	293

Mean Total Charge, Proportion of Admissions and Number of Cases by Change in Purpose of Admission Status

Breast Cancer

Purpose Admission Change	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Yes	56	19.11%	$9,899	$6,517	$745	$82,667	$13,065
No	237	80.89%	$5,503	$4,020	$289	$39,707	$4,743
All Groups	293	100.00%	$6,332	$4,357	$289	$82,667	$7,274

Table 49

Number of Cases, Percent of Total Cases, and Total Charge by Admission Purpose Group

Colon Cancer

Admission Group	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Major Surgery w/ Dx Eval	76	27.94%	$12,481	$7,754	$1,849	$83,646	$16,057
Major Surgery w/o Dx Eval	80	29.41%	$8,359	$7,082	$2,313	$55,390	$6,325
Active Tx w/ Dx Eval	6	1.64%	$5,284	$4,624	$861	$10,082	$3,928
Active Tx w/o Dx Eval	9	3.31%	$6,683	$3,493	$1,651	$32,976	$9,949
Dx Eval Only	47	17.28%	$10,637	$9,453	$713	$26,348	$6,617
Palliation	43	16.61%	$8,022	$6,090	$650	$40,929	$8,727
Other	12	4.41%	$20,631	$13,077	$3,179	$62,667	$24,065
All Groups	272	100.00%	$10,287	$7,478	$650	$83,848	$11,796

Table 50

Number of Cases, Percent of Total Cases, and Total Charge by Initial/Subsequent Admission Groups

Colon Cancer

Init/Sub Adm. Group	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
No	109	40.07%	$9,109	$6,506	$713	$73,280	$10,422
Yes	163	59.93%	$11,066	$7,973	$650	$83,646	$12,595
All Groups	272	100.00%	$10,287	$7,476	$650	$83,646	$11,796

Table 51

Number of Cases, Percent of Total Cases, and Total Charge by Initial/Subsequent Admission Groups

Colon Cancer

Init/Sub Adm. Group	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
No								
Mean Charge	$17,764	$7,532	$6,011	$6,683	$6,063	$7,708	$15,805	$9,109
% of Cases	13.8%	28.4%	3.7%	8.3%	11.0%	29.4%	5.5%	100.0%
N	15	31	4	9	12	32	6	109
Yes								
Mean Charge	$11,244	$8,858	$2,378	--	$12,118	$9,029	$25,857	$11,068
% of Cases	37.4%	30.1%	.6%		21.5%	6.7%	3.7%	100.0%
N	61	49	1		35	11	6	163
All Cases								
Mean Charge	$12,461	$8,359	$5,284	$6,683	$10,537	$8,022	$20,831	$10,287
% of Cases	27.9%	29.4%	1.8%	3.3%	17.3%	15.8%	4.4%	100.0%
N	76	80	5	9	47	43	12	272

Table 52

Number of Cases, Percent of Total Cases, and Total Charge by DNR Status

Colon Cancer

DNR Status	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
Yes								
Mean Charge	$14,104	$8,433	--	$12,529	$14,507	$10,565	$38,825	$14,145
% of Cases	7.3%	7.3%		7.3%	14.6%	53.7%	9.8%	100.0%
N	3	3		3	6	22	4	41
No								
Mean Charge	$12,393	$8,358	$5,284	$3,780	$9,942	$5,226	$11,834	$9,584
% of Cases	31.6%	33.3%	2.2%	2.6%	17.7%	9.1%	3.5%	100.0%
N	73	77	5	6	41	21	8	231
All Cases								
Mean Charge	$12,481	$8,359	$5,284	$6,683	$10,537	$8,022	$20,831	$10,287
% of Cases	27.9%	29.4%	1.8%	3.3%	17.3%	15.8%	4.4%	100.0%
N	76	80	5	9	47	43	12	272

Table 53

Mean Total Charge, Proportion of Admissions and Number of Cases by Death and Admission Purpose Groups

Colon Cancer

Dead?	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
Yes								
Mean Charge	$17,851	$9,677	$8,478	--	$14,844	$8,567	$52,969	$11,939
% of Cases	4.2%	8.3%	4.2%		16.7%	62.5%	4.2%	100.0%
N	1	2	1		4	15	1	24
No								
Mean Charge	$12,388	$8,323	$4,485	$8,883	$10,127	$7,720	$17,909	$10,123
% of Cases	30.2%	31.5%	1.6%	3.6%	17.3%	11.3%	4.4%	100.0%
N	75	78	4	9	43	28	11	248
All Cases								
Mean Charge	$12,481	$8,359	$5,284	$8,883	$10,537	$8,022	$20,831	$10,287
% of Cases	27.9%	29.4%	1.8%	3.3%	17.3%	15.8%	4.4%	100.0%
N	76	80	5	9	47	43	12	272

Table 54

Mean Total Charge, Proportion of Admissions and Number of Cases by Change in Purpose of Admission Status

Colon Cancer

Purpose Admission Change	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Yes	61	22.43%	$15,832	$11,874	$2,313	$82,667	$15,090
No	211	77.57%	$8,707	$6,824	$650	$83,646	$10,177
All Groups	272	100.00%	$10,287	$7,478	$650	$83,646	$11,796

Table 55

Number of Cases, Percent of Total Cases, and Total Charge by Admission Purpose Group

Lung Cancer

Admission Group	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Major Surgery w/ Dx Eval	39	13.31%	$13,300	$9,821	$3,189	$82,687	$13,931
Major Surgery w/o Dx Eval	16	5.46%	$8,590	$9,283	$2,683	$12,745	$2,931
Active Tx w/ Dx Eval	12	4.10%	$6,242	$4,405	$2,962	$18,665	$4,710
Active Tx w/o Dx Eval	34	11.60%	$3,911	$2,641	$565	$14,329	$2,732
Dx Eval Only	87	29.69%	$5,641	$3,640	$472	$34,653	$5,688
Palliation	93	31.74%	$4,673	$3,388	$289	$26,269	$4,508
Other	12	4.10%	$4,988	$3,422	$1,219	$13,329	$4,214
All Groups	293	100.00%	$6,332	$4,357	$289	$82,867	$7,274

Table 56

Number of Cases, Percent of Total Cases, and Total Charge by Initial/Subsequent Admission Groups

Lung Cancer

Init/Sub Adm. Group	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
No	152	51.88%	$4,776	$3,527	$289	$28,954	$3,994
Yes	141	48.12%	$7,968	$6,318	$472	$82,667	$9,321
All Groups	293	100.00%	$6,332	$4,357	$289	$82,867	$7,274

Table 57

Number of Cases, Percent of Total Cases, and Total Charge by Initial/Subsequent Admission Groups

Lung Cancer

Init/Sub Adm. Group	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
No								
Mean Charge	$8,718	$7,345	$6,246	$4,044	$5,126	$4,133	$4,051	$4,776
% of Cases	4.6%	5.9%	5.3%	19.7%	14.5%	46.1%	3.9%	100.0%
N	7	9	8	30	22	70	6	152
Yes								
Mean Charge	$14,335	$10,190	$6,234	$2,953	$5,804	$6,222	$8,065	$7,968
% of Cases	22.7%	5.0%	2.8%	2.8%	46.1%	16.3%	4.3%	100.0%
N	32	7	4	4	65	23	6	141
All Cases								
Mean Charge	$13,300	$8,590	$6,242	$3,911	$5,641	$4,673	$4,966	$6,332
% of Cases	13.3%	5.5%	4.1%	11.6%	29.7%	31.7%	4.1%	100.0%
N	39	16	12	34	87	93	12	293

Table 68

Number of Cases, Percent of Total Cases, and Total Charge by DNR Status

Lung Cancer

DNR Status	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
Yes								
Mean Charge	$26,275	$6,916	$4,169	$4,612	$10,631	$5,098	$6,025	$6,276
% of Cases	3.1%	1.5%	4.6%	4.6%	9.2%	69.2%	7.7%	100.0%
N	2	1	3	3	6	45	6	66
No								
Mean Charge	$12,579	$8,766	$6,702	$3,661	$6,521	$4,276	$4,084	$6,347
% of Cases	16.2%	6.6%	3.9%	13.6%	36.6%	21.1%	3.1%	100.0%
N	37	16	9	31	61	46	7	226
All Cases								
Mean Charge	$13,300	$6,690	$6,242	$3,911	$6,641	$4,673	$4,966	$6,332
% of Cases	13.3%	6.6%	4.1%	11.6%	29.7%	31.7%	4.1%	100.0%
N	39	16	12	34	67	93	12	293

Table 59

Mean Total Charge, Proportion of Admissions and Number of Cases by Death and Admission Purpose Groups

Lung Cancer

Dead?	Major Surg w/ Dx Eval	Major Surg w/o Dx Eval	Active Tx w/ Dx Eval	Active Tx w/o Dx Eval	Dx Eval Only	Palliation	Other	All Groups
Yes								
Mean Charge	$25,879	$5,918	$11,083	$4,895	$9,274	$3,988	$8,086	$7,298
% of Cases	7.7%	1.9%	5.8%	3.8%	17.3%	57.7%	5.8%	100.0%
N	4	1	3	2	9	30	3	52
No								
Mean Charge	$11,844	$8,768	$8,186	$3,881	$5,253	$4,987	$3,798	$8,133
% of Cases	14.5%	6.2%	3.7%	13.3%	32.4%	26.1%	3.7%	100.0%
N	35	15	9	32	78	63	9	241
All Cases								
Mean Charge	$13,300	$8,590	$8,242	$3,911	$5,641	$4,673	$4,968	$8,332
% of Cases	13.3%	5.5%	4.1%	11.6%	29.7%	31.7%	4.1%	100.0%
N	39	16	12	34	87	93	12	293

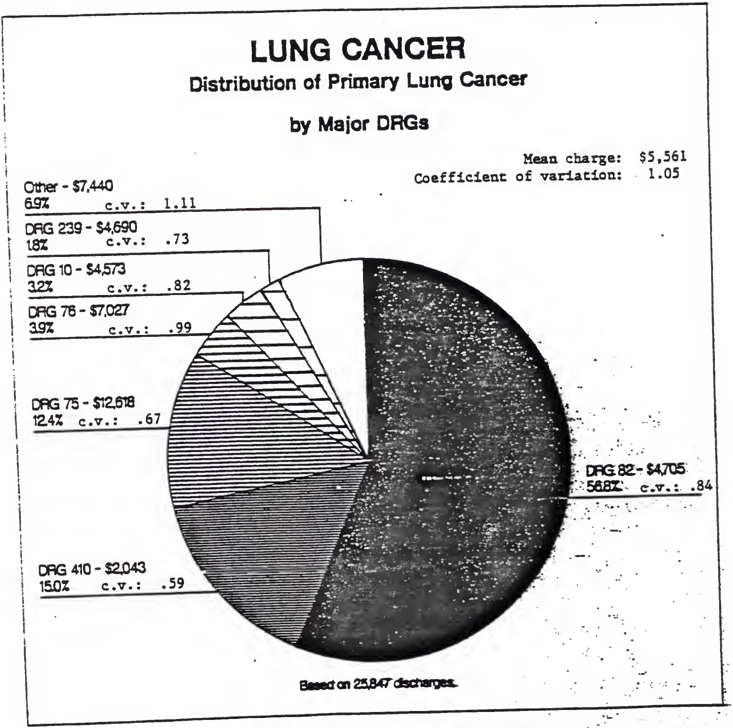
Table 60

Mean Total Charge, Proportion of Admissions and Number of Cases by Change in Purpose of Admission Status

Lung Cancer

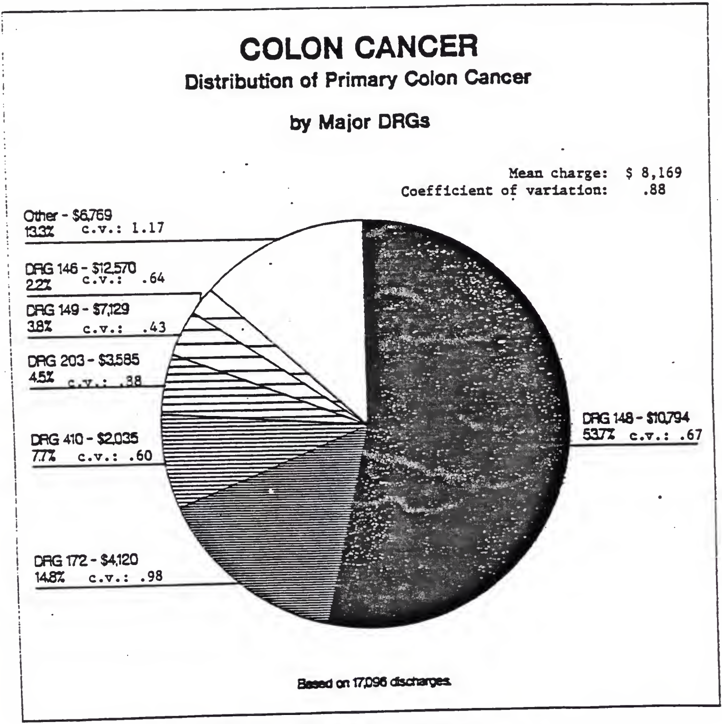
Purpose Admission Change	N	% of Cases	Mean Charge	Median Charge	Minimum Charge	Maximum Charge	Standard Deviation
Yes	56	19.11%	$9,899	$6,517	$745	$82,667	$13,065
No	237	80.89%	$5,503	$4,020	$289	$39,707	$4,743
All Groups	293	100.00%	$6,332	$4,357	$289	$82,667	$7,274

Figure 1



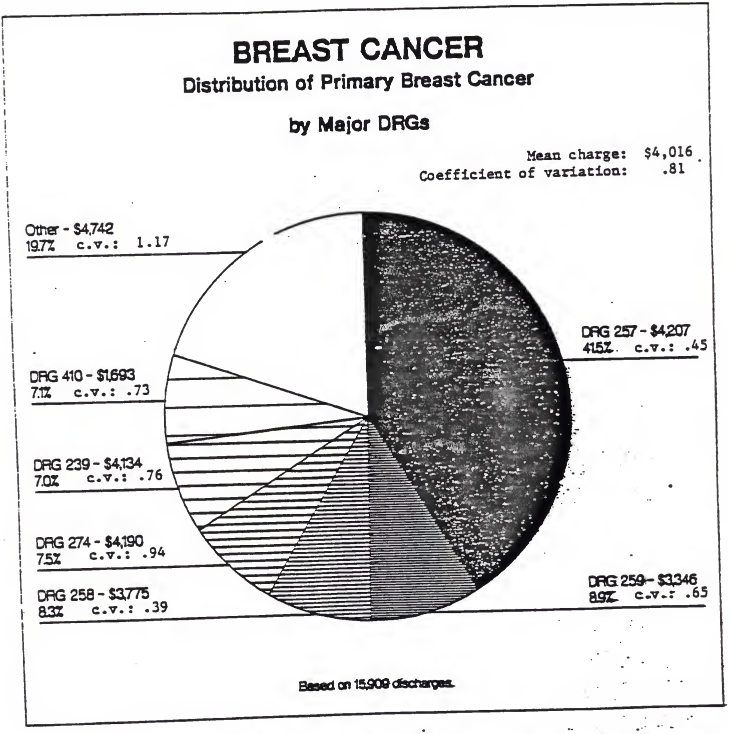
DRG 10 - Nervous system neoplasms, over age 69 or with c.c.
DRG 75 - Major chest procedures
DRG 76 - OR procedures on respiratory system except major chest with c.c.
DRG 82 - Respiratory neoplasms
DRG 239 - Pathological fractures and musculoskeletal and connective tissue maligna
DRG 410 - Chemotherapy

Figure 2



DRG 146 - Rectal resection over age 69 or with c.c.
DRG 148 - Major small and large bowel procedures, over age 69 or with c.c.
DRG 149 - Major small and large bowel procedures under age 70 without c.c.
DRG 172 - Digestive malignancy over age 69 or with c.c.
DRG 203 - Malignancy of hepatobiliary system or pancreas
DRG 410 - Chemotherapy

Figure 3


BREAST CANCER
Distribution of Primary Breast Cancer
by Major DRGs

Mean charge: $4,016
Coefficient of variation: .81

Based on 15,909 discharges.

DRG 239 - Pathological fractures and musculoskeletal and connective tissue malign
DRG 257 - Total mastectomy for malignancy, over age 69 or with c.c.
DRG 258 - Total mastectomy for malignancy, under age 70 without c.c.
DRG 259 - Subtotal mastectomy for malignancy over age 69 or with c.c.
DRG 274 - Malignant breast disorders over age 69 or with c.c.
DRG 410 - Chemotherapy

Figure 4

DRG 310

Transurethral Procedures over Age 69 or with C.C.

$ 2,947
C.V.= .68
N= 10,402

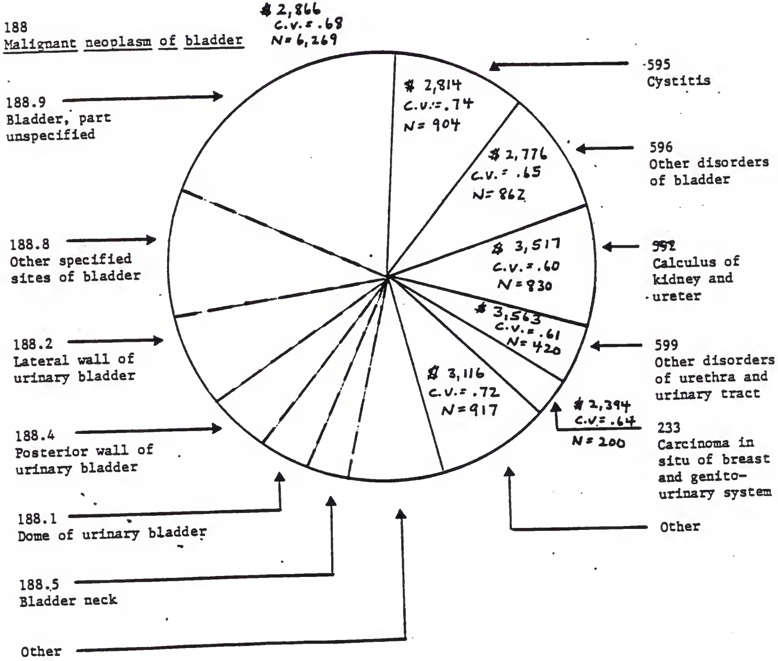


Figure 5

DRG 336

Transurethral Prostatectomy over Age 69 or with C.C.

$ 3,833
C.V. = .52
N = 29,769

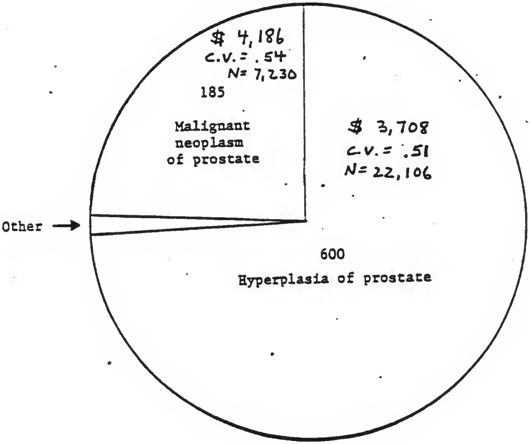
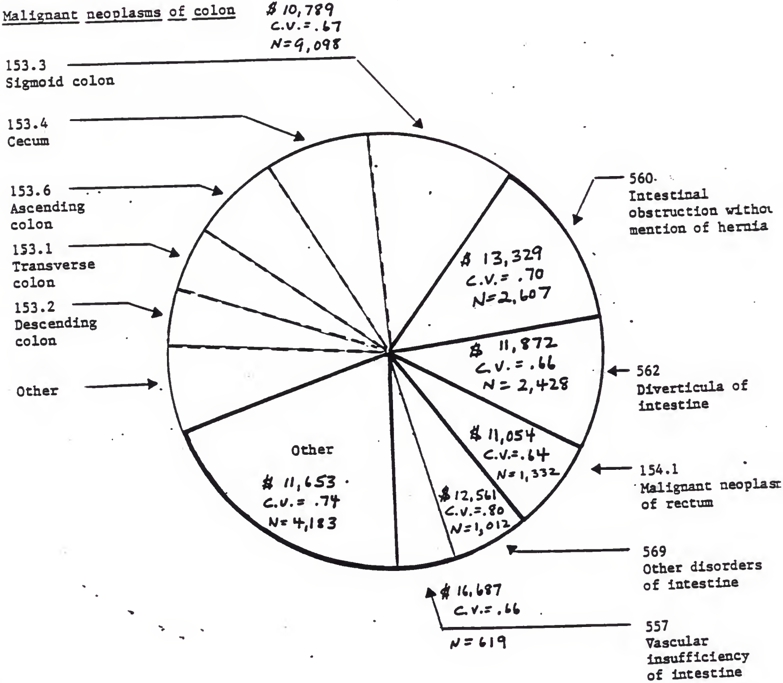


Figure 6

DRG 148

Major Small and Large Bowel Procedures over Age 69 or with C.C.

$ 11,666
C.V. = .71
N = 21,279



APPENDIX A

COMPLICATION CODES

ICD-9-CM CODE	LABEL
038	Septicemia
263	Other and unspecified protein-calorie malnutrition
345	Epilepsy
457	Noninfectious disorders of lymphatic channels
466	Acute bronchitis and bronchiolitis
480	Viral pneumonia
481	Pneumococcal pneumonia
482	Other bacterial pneumonia
483	Pneumonia due to other specified organism
484	Pneumonia in infectious diseases classified elsewhere
485	Bronchopneumonia, organism unspecified
486	Pneumonia, organism specified
487	Influenza
507	Pneumonitis due to solids and liquids
508	Respiratory conditions due to other and unspecified external agents
510	Empyema
511	Pleurisy
512	Pneumothorax
513	Abscess of lung and mediastinum
528	Diseases of the oral soft tissues, excluding lesions specific to gingiva and tongue
560	Intestinal obstruction without mention of hernia
567	Peritonitis
578	Gastrointestinal hemorrhage
611	Other disorders of breast
683	Acute lymphadenitis
786	Symptoms involving respiratory system and other chest symptoms
909	Late effects of other and unspecified external causes
998	Other complications of procedures, not elsewhere specified
999	Complications of medical care, not elsewhere specified
2754	Disorders of calcium metabolism
2765	Volume depletion
2859	Anemia, Specified
2869	Other and unspecified coagulation defects
2874	Secondary thrombocytopenia
2875	Thrombocytopenia, unspecified
2880	Agranulocytosis
3313	Communicating hydrocephalus
3314	Obstructive hydrocephalus
3363	Myelopathy in other diseases
3446	Cauda equina syndrome
3573	Polyneuropathy in malignant disease
4151	Pulmonary embolism and infarction
4783	Paralysis of vocal cords or larynx
5180	Pulmonary collapse
5354	Other specified gastritis
5355	Unspecified gastritis and gastroduodenitis
5362	Persistent vomiting
5373	Other obstruction of duodenum

ICD-9-CM CODE	LABEL
5581	Gastroenteritis and colitis due to radiation
6822	Trunk
7331	Pathological fracture
7800	Coma and stupor
7803	Convulsions
7806	Pyrexia of unknown origin
7807	Malaise and fatigue
7809	Other general symptoms
7991	Respiratory failure
9952	Unspecified adverse effect of drug, medicinal and biological substance
9973	Respiratory complications
V580	Radiotherapy session
V581	Maintenance chemotherapy
V661	Following radiotherapy
V662	Following chemotherapy
V671	Following radiotherapy
V672	Following chemotherapy (cancer chemotherapy follow-up)

APPENDIX B

MAJOR SURGERY

ICD-9-CM CODE	LABEL
01.2-03.29	CNS
03.4-04.07	(exclude 03.42, 03.80, 03.91, 03.92, 03.94)
04.21-04.79	(exclude 04.34, 04.51, 04.52, 04.54, 04.57, 04.61)
04.9-05.0	
05.2-05.29	
05.8-06.09	
06.2-07.02	Endocrine
07.2-08.09	
08.2-09.0	Eyelid (exclude 08.76)
09.2-10.1	(exclude 09.92)
10.3-11.1	Eye
11.3-12.14	Eye
12.3-14.02	Eye
14.2-14.9	Eye
15.1-16.09	Eye (exclude 15.41)
16.3-18.09	Eye/ear
18.2-20.23	Ear (exclude 18.76, 18.87, 19.74, 19.61, 20.00)
20.4-20.99	Ear
21.33-22.02	Nose
22.2-22.9	Nasal sinus (exclude 22.23)
25.1-26.0	Tongue
26.2-27.1	Salivary
27.3-28.0	Palate (exclude 27.65)
28.2-29.0	Tonsils (exclude 28.84)
29.2-30.4	Larynx (exclude 29.21, 29.90)
31.5-31.99	Larynx, trachea
32.0-33.1	Major lung surgery
33.3-3.99	Other lung (exclude 33.31, 33.32)
34.3-34.59	Pleura (exclude 34.52)
34.7-34.89	Other chest
34.93	Pleura
35.0-37.12	Heart (exclude 37.09)
37.3-37.5	Heart
38.0-38.1	Endarterectomy
38.3-38.8	Vessels (exclude 38.74)
39-39.94	Blood vessels
40.3-41.2	Lymph nodes
41.4-41.99	Spleen
42.0-42.19	Esophagus
42.3-44.03	Stomach (exclude 42.81, 42.92, 43.10, 43.20)
44.2-44.03	Stomach
45.3-48.1	Major bowel surgery (exclude 45.70, 46.00, 46.39, 48.00)
48.31-49.12	Rectum (exclude 48.32)
49.3-49.9.	Anus
50.2-51.04	Liver
51.2-52.09	Binary tract
52.2-52.83	Pancreas
52.92-54.0	Hernia

ICD-9-CM CODE	LABEL
54.3-54.75	Abdomen
54.92-54.95	Peritoneum
55.0-55.12	Kidney
55.3-56.2	Kidney (exclude 55.93, 56.09)
56.4-56.99	Ureter
57.2-57.22	Bladder
58.0-58.1	Bladder
58.3-59.19	Urethra (exclude 58.60)
59.3-60.0	Perirenal (exclude 59.80)
60.2-60.99	Prostate
61.2-62.0	Scrotum (exclude 61.91)
6.2.-62.99	Testes (exclude 62.40)
63.1-63.99	Vasectomy (exclude 63.32)
62.2-64.99	Penis
65.0	Ovary
65.2-66.0	Ovary
66.2-66.99	Fallopian tubes
67.2-68.0	Cervix
68.2-69.59	Uterus
70.3-71.9	Vagina
76.0-76.09	Facial bone
76.2-77.3	Bone
77.5-78.7	Bone
78.9-80.1	Bone (exclude 79.01, 79.05, 79.09)
80.4-81.87	Joint
81.93-81.96	Joint
82.0-82.91	Muscle (exclude 82.10)
83.0-83.91	Tendon
84.0-84.99	Amputation (exclude 84.43, 84.45)
85.2-85.89	Breast (exclude 85.81)
86.4	Skin
86.4-86.91	Major skin (exclude 86.59)

APPENDIX C

DIAGNOSTIC PROCEDURES

ICD-9-CM CODE	LABEL
01.10-01.19	Brain
03.3-03.39	Spinal cord
04.1-04.19	Perip nerves
05.1-05.19	Ganglion
06.1-06.19	Thyroid
07.1-07.19	Endocrine
08.1-08.19	Eyelid
09.1-09.19	Lacrimal system
10.2-10.29	Conjunctiva
11.2-11.29	Cornea
12.2-12.29	Eye
14.1-14.19	Retina
15.0-15.09	Extraocular muscles
16.2-16.29	Eyeball
18.1-18.19	Ear
20.3-20.39	Inner ear
21.2-21.29	Nose
22.1-22.19	Nasal sinus
25.0-25.09	Tongue
26.1-26.19	Salivary gland
27.2-27.29	Oral cavity
28.1-28.19	Tonsils
29.1-29.19	Pharynx
31.0, 31.4-31.49	Larynx, trachea
33.2, 33.21-33.23	Bronchoscopy
33.24-33.27	Lung biopsy
33.28-33.29	Other lung
34.2-34.29	Other thorax
34.02-34.03	Other thorax
34.91	Thoracentesis
34.92	Thorax
37.2-37.29	Heart
38.2-38.29	Blood vessel
40.0-40.29	Lymph node
41.3-41.39	Bone marrow
42.4-42.49	Esophagus
44.1-44.19	Stomach
45.1-45.29	Endoscopy and biopsy of bowel
48.2-48.29	Rectum
49.2-49.29	Anus
50.1-50.19	Liver
51.5-51.19	Biliary tract
52.1-52.19	Pancreas
52.91	ERCP (pancreas)
54.1-54.29	Abdomen
54.91	Paracentesis
55.2-55.29	Kidney
56.3-56.39	Ureter

DIAGNOSTIC PROCEDURES (Cont'd)

ICD-9-CM CODE	LABEL
57.3-57.39	Bladder (includes cystoscopy)
58.2-58.29	Urethra
59.2-59.29	Rebroperitoneum
60.1-60.19	Prostate
60.1-60.19	Scrotum
62.1-62.19	Testes
63.0-63.09	Spermatic cord
64.1-64.19	Penis
65.1-65.19	Ovary
66.1-66.19	Fallopian tubes
67.1-67.19	Cervix
68.1-68.19	Uterus
70.2-70.29	Vagina
76.1-76.19	Facial bones
77.4	Bone
78.8	Bone
80.2	Arthroscopy
80.3	Joint
81.91	Arthrocentesis
81.98	Joint
83.2-83.29	Muscle
85.0-85.19	Breast
86.1-86.19	Skin

Radiology

87.0-87.09	Head (exclude dental x-rays)
87.13-87.43	Chest (exclude routine chest x-ray 87.44)
87.49-88.89	

Other diagnostic maneuvers

89.21-89.25	Urinary flow
89.32	Esophageal manometry
89.37-89.38	PFTs
89.41-89.44	Stress test

Nuclear medicine scans

92.0-92.19

APPENDIX D

ACTIVE TREATMENT

ICD-9-CM CODE	LABEL
31.1, 31.2-31.29	Tracheostomy
34.6	Scarification of pleura
34.01, 34.04, 34.09	Chest tube
	(excludes venipuncture 38.99)
38.9-38.98	(arterial puncture, catheterization)
39.95	Hemodialysis
39.96-39.99	Control of hemorrhage
37.6-37.89	Active treatment of heart (includes pacemaker)
37.9-37.99	Treatment (as during an arrest)
54.97-54.98	Peritoneal dialysis
85.9-85.99	Active treatment breast (includes implants)
89.6-89.69	Includes ICU monitoring techniques
92.2-92.29	Radiation therapy
93.91-93.93	Mechanical ventilation
96.01-96.05	Intubation of respiratory tract
99.24	Injection of other hormone
99.25	Injection of chemotherapy
99.60, 99.62-99.63	Cardiopulmonary resuscitation

APPENDIX F

ONCOLOGY MEDICAL RECORD REVIEW STUDY
INTER-RATER RELIABILITY

VARIABLE	RELIABILITY	NOTES
Patient ID Number	r = 1.00	
Birthdate	r = 1.00	
Admission Date	r = 1.00	
Discharge Date	r = 1.00	
Did patient expire (#agreeing/total #)	74/76 = 97%	
First listed diagnosis "		
Breast	24/26 = 92%	
Colon	22/26 = 85%	
Lung	22/24 = 92%	
Second listed diagnosis "		
Breast	16/26 = 62%	
Colon	21/26 = 81%	
Lung	18/24 = 75%	
Third listed diagnosis "		
Breast	20/26 = 77%	
Colon	18/26 = 69%	
Lung	19/24 = 79%	
Was patient transferred? "	75/76 = 99%	
Urgency of admission "	34/76 = 45%	
Referral source "	54/76 = 71%	
Initial admission for cancer "	63/76 = 83%	
Number of previous admissions "	61/76 = 80%	Mostly no data (56 cases)
Last discharge date "	r = 0.30	Mostly no data (6 cases)
Purpose of admission "	76/76 = 100%	Used mutually exclusive categories for calculation

VARIABLE	RELIABILITY	NOTES
Temperature	r = .75	
Systolic BP	r = .63	
Diastolic BP	r = .81	
Heart Rate	--	Only rated once
Respiratory Rate	--	Only rated once
Sodium	--	Only rated once
Potassium	r = .96	Data on 53 cases
Albumin	r = .78	Data on 39 cases
WBC	r = .94	Data on 65 cases
Bicarbonate	--	Only rated once
Creatinine	--	Only rated once
BUN	--	Only rated once
Hematocrit	--	Only rated once
PO2	--	Only rated once
Ph	--	Only rated once
History of liver insufficiency *	74/76 = 97%	Mostly missing data (74 cases)
History of cardiovascular insufficiency *	60/76 = 79%	
History of respiratory insufficiency *	61/76 = 80%	All positive response (N = 15) did not match
History of renal insufficiency *	76/76 = 100%	All cases missing data
Immunocompromised host *	65/76 = 86%	
Number of ICU days	r = .64	
Was patient DNR? *	69/76 = 91%	
When was DNR established? *	67/76 = 88%	Mostly unknown
Date DNR established	--	All missing data
H/O chronic pulmonary disease *	66/76 = 87%	

VARIABLE		RELIABILITY	NOTES
H/O M.I. over 6 months	"	72/76 = 95%	Mostly no data (no matches on positive response)
H/O congestive heart failure	"	71/76 = 93%	
H/O severe dementia	"	75/76 = 99%	
H/O moderate dementia	"	68/76 = 89%	Mostly no data (no matches on positive response)
H/O diabetes requiring insulin	"	73/76 = 96%	Mostly no data (no matches on positive response)
H/O diabetes - no insulin	"	71/76 = 93%	
Did admission purpose change?	"	66/76 = 87%	
Admission purpose at discharge	"	11/11 = 100%	
Did treatment change B/C of mets	"	68/76 = 89%	No match on positive response
Discharge status			
Home	"	42/76 = 55%	
Home w/ h.h.	"	67/76 = 88%	
AMA	"	76/76 = 100%	All missing
Hospice	"	75/76 = 99%	Mostly missing (no match on positive response)
ICF	"	74/76 = 97%	Mostly missing data (no match on positive response)
SNF	"	71/76 = 93%	Mostly missing data (no match on positive response)
Acute Care Facility	"	76/76 = 100%	All missing
Chronic disease hospital	"	75/76 = 99%	
Expired	"	70/76 = 92%	
Other	"	76/76 = 100%	

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